5.0 Cumulative Impacts

This chapter provides an analysis of the cumulative effects of past, present, and reasonably foreseeable future actions on various natural and human resources. The following sections identify the time frame for effects, the past, present, and reasonably foreseeable future projects analyzed; and the cumulative impacts for each resource. The primary human influences in the area have been oil and gas development, historic and current gilsonite mining, and livestock grazing. The compilation of these actions provides the basis for estimating future environmental changes that may affect the extent and quality of natural and human resources.

5.1 Time Frame

Based on the project development and operational periods (up to 50 years), and the time frame for vegetation and wildlife habitat recovery in saltbush and sagebrush communities, the overall time frame for the effects of cumulative surface disturbing activities is 75 years. KMG estimates that wells may have productive lives of 30 to 50 years.

5.2 Past, Present, and Reasonably Foreseeable Future Projects

Table 5.2-1 identifies the Cumulative Impact Study Areas (CISAs) for individual resources and resource issues, and the rationale for the selection of each area. Because of the many projects that have recently been approved or are in the approval process, the general cumulative effects area covers three reasonably foreseeable development (RFD) areas: Monument Butte – Red Wash, West Tavaputs Plateau, and East Tavaputs Plateau (**Figure 5.2-1**). This area includes much of the southern half of the Uinta Basin and is managed under the BLM Vernal RMP (BLM 2008c). There is no equivalent resource management guidance for Tribal, state, or private lands. **Figure 5.2-2** shows the locations of past, present, and reasonably foreseeable future actions included in the general cumulative effects area for oil and gas field development projects. **Figure 5.2-3** shows the locations of pipeline and seismic projects in the BLM Vernal Field Office that were considered as part of the cumulative impact analysis for vegetation. **Figure 5.2-4** shows the relationship of pipeline projects and well development projects used for the cumulative impact analysis for wildlife resources.

5.2.1 Oil and Gas

5.2.1.1 Exploration and Production

Oil and gas development in the GNBPA and surrounding region began in the 1950s and 1960s, and rapidly increased in the 1990s. As presented in Chapter 2.0, existing oil and gas development in the GNBPA includes 1,562 well pads and a total existing surface disturbance of 7,766 acres (**Table 2.2-1**). Under the No Action Alternative, an additional 1,102 well pads with a surface disturbance of 4,702 acres remain to be developed as disclosed in existing NEPA decision documents (**Table 2.4-1**). In addition to these existing and approved development activities within the GNBPA, **Table 5.2-2** provides a list of past and present oil and gas development projects, and **Table 5.2-3** presents estimates for reasonably foreseeable oil and gas activity in the general cumulative effects area for the proposed project. The projects listed as reasonably foreseeable include those for which NEPA decision documents are anticipated or in-process but have not yet been completed.

It is assumed that the portion of the projects listed in **Table 5.2-2** that are within the GNBPA are accounted for as part of the existing and approved activities disclosed in **Tables 2.2-1** and **2.4-1**. Therefore, the disturbance outside of the GNBPA is calculated on **Table 5.2-2**.

Table 5.2-1 Cumulative Impact Study Areas for the Greater Natural Buttes EIS

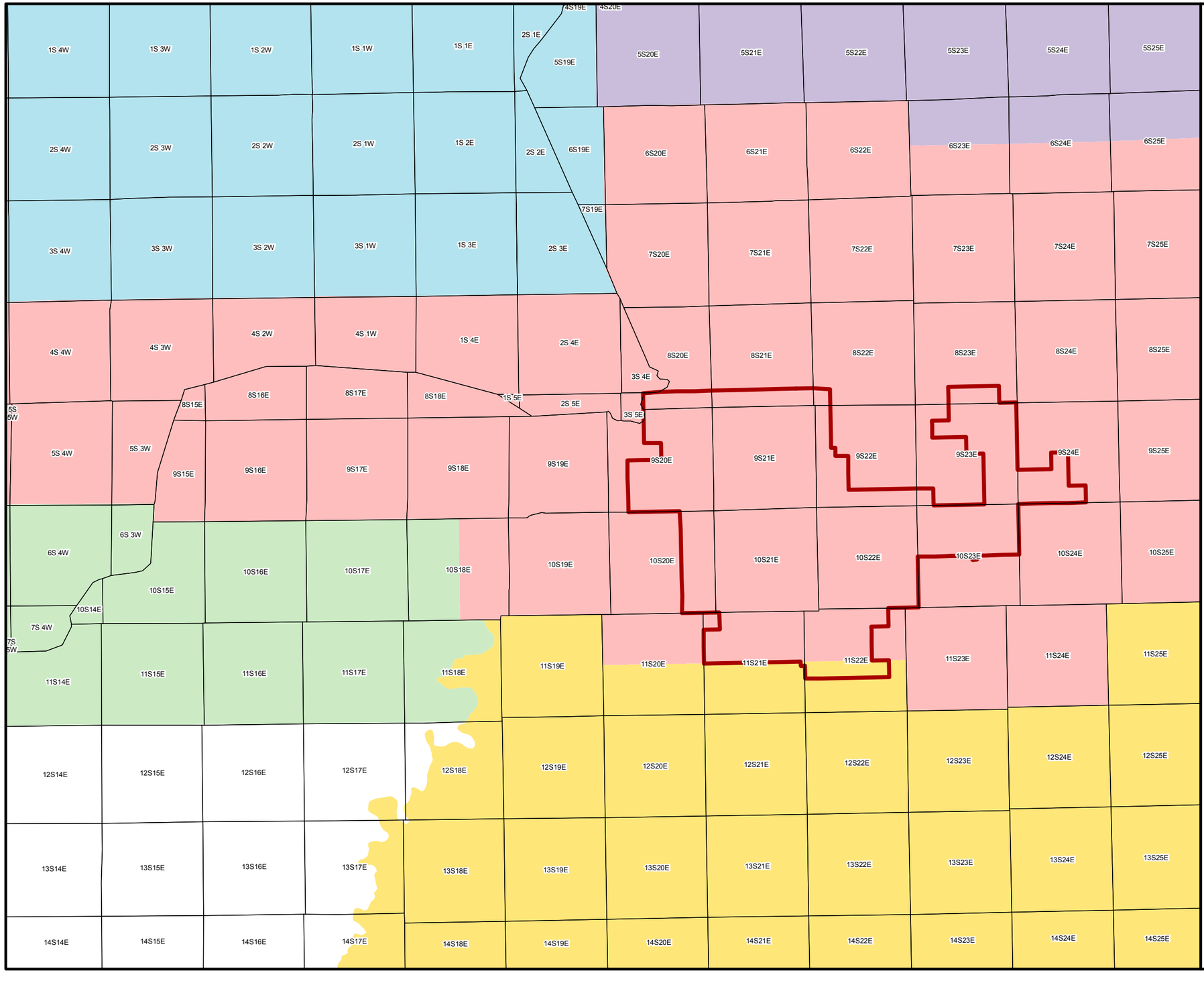
Resource	Cumulative Impacts Study Area	Study Area Rationale/Interrelated Projects
Air Quality	Eastern Uinta Basin and additional study areas in the region as identified at the direction of the BLM	The Uinta Basin is bounded by higher terrain on all sides, which results in similar climate and dispersion conditions for pollutants. Projects: All human and natural activities within the Uinta Basin that inject pollutants into the air.
Cultural Resources	GNBPA boundary	Archaeological sites generally are located in discrete areas and effects on these sites are a consequence of implementing surface disturbance activities associated with a development proposal. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, and Greater Chapita Wells Infill EIS.
Native American Traditional Cultural Properties	GNBPA boundary	The location of cultural resources is site-specific, and effects are a consequence of implementing a development proposal. However, traditional use areas, religious sites, and certain archaeological sites have to be considered in an expanded landscape context. This area encompasses major regional landscape and cultural features (Green River corridor and major Green River tributaries) as well as intensive oil and gas development. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, and Greater Chapita Wells Infill EIS.
Geology	For oil shale, the study area is the portion of the KOSLA within the GNBPA. For all other geologic and mineral resources, the study area is the GNBPA.	For oil shale, the known leasing area identifies areas of high potential for development near the GNBPA. For other resources, the area encompasses similar oil and gas, gilsonite, and tar sands deposits with similar extraction methods and similar potential for geologic hazards. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, and Greater Chapita Wells Infill EIS.
Land Use	GNBPA and the immediate surrounding area as defined by the management objectives for visibility, noise, and wildlife for the boundary of the White River SRMA, as defined in the Vernal RMP.	These environmentally sensitive areas require the most planning regarding potential impacts and also may provide the most constraints for development within their boundaries. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, Greater Chapita Wells Infill EIS, Southam Canyon EA, RDG Uinta Basin EIS, and Greater Deadman Bench EIS. • White River SMRA: Bonanza EA and Rock House EA.
Paleontology	GNBPA boundary	Impacts would be limited to direct surface disturbance. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, and Greater Chapita Wells Infill EIS.
Range Resources	The entirety of each grazing allotment all or partially within the GNBPA	Grazing allotments define the type and level of livestock use, and use boundaries by individual permitees. Ute Tribe grazing allotments do not overlap those of the BLM. Projects: Little Canyon EA, Bonanza EA, Chapita Wells-Stagecoach EIS, Big Pack EA, Greater Deadman Bench EIS, Love Unit EA, North Chapita EA, RDG Uinta Basin EIS, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Greater Chapita Wells Infill EIS, and Southam Canyon EA.

Table 5.2-1 Cumulative Impact Study Areas for the Greater Natural Buttes EIS

Resource	Cumulative Impacts Study Area	Study Area Rationale/Interrelated Projects
Recreation	GNBPA with a 2-mile buffer outside the boundary	These roads make up some of the regional recreational travel corridors that intersect the GNBPA. The OHV designations provide specific management guidance on certain areas within the Vernal RMP jurisdiction. This is the area within which public users (travelers on roads, boaters on the White River) would hear industrial noise resulting from oil and gas operations. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, Hill Creek EA, RDG Uinta Basin EIS, Greater Chapita Wells Infill EIS, and Southam Canyon EA.
Socioeconomics	Uintah and Duchesne counties of Utah	These two counties house a majority of the gas field workers and gas field service companies supporting this and other projects across the Uinta Basin and nearby areas of Colorado and Wyoming. Fiscal benefits and costs would be felt at the county and municipal levels. Communities that house labor, as well as provide goods and services are located within these counties. This area is the proper regional scale for consideration of these effects because of the mixture of land ownerships (federal, tribal, state, and private). Projects: All major natural resource and construction activities in the region, along with tourism, outdoor recreation, grazing, and other economic activities.
Soils	GNBPA boundary	The site-specific management of vegetation and noxious weeds and invasive species affect erosion and sedimentation rates within the oil and gas development area. Land uses, revegetation success, and the potential introduction and/or spread of noxious weeds and invasive species are comparable throughout this area. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, and Greater Chapita Wells Infill EIS.
Transportation	GNBPA and primary access roads to the area for transportation	This is the area within which the public and oil and gas developers would see the potential changes and impacts on the transportation network (**Figure 2.4-1**). Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, Hill Creek EA, RDG Uinta Basin EIS, Greater Deadman Bench EIS, and Greater Chapita Wells Infill EIS.
Vegetation	GNBPA boundary	The site-specific management of vegetation and noxious weeds and invasive species affect erosion and sedimentation rates within the oil and gas development area. Land uses, revegetation success, and the potential introduction and/or spread of noxious weeds and invasive species are comparable throughout this area. Projects: Bonanza EA, Love Unit EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Little Canyon EA, and Greater Chapita Wells Infill EIS. Existing and proposed pipeline and seismic projects that intersect the GNBPA.

Table 5.2-1 Cumulative Impact Study Areas for the Greater Natural Buttes EIS

Resource	Cumulative Impacts Study Area	Study Area Rationale/Interrelated Projects
Visual Resources	Boundary of the VRM Class II areas within the GNBPA as well as the viewshed of the proposed project, particularly for views to and from the Duchesne, Green, and White rivers.	This is the area within which public users (travelers on roads, recreational campers and hikers, and boaters on the Duchesne, Green, and White rivers) would see potential changes in the landscape resulting from oil and gas development. Projects: Bonanza EA, Castle Peak and Eightmile Flat EIS, Monument Butte EIS, Gasco Uinta Basin EIS, Gasco Riverbend EA, Love Unit EA, North Alger EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, RDG Uinta Basin EIS, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Greater Deadman Bench EIS, Newfield Gusher EA, Little Canyon EA, Hill Creek EA, West Tavaputs Plateau EIS, Wilkin Ridge EA, Greater Chapita Wells Infill EIS, Southam Canyon EA, and ANF South Unit EIS.
Water Resources	For surface water: the entirety of the following hydrographic basins: Duchesne River, Pelican Lake-Green River, Cottonwood Wash-White River, Coyote Wash, Lower Pariette Draw, Agency Draw-Willow Creek, Sheep Wash-Green River, Asphalt Wash, White River, Bitter Creek, and Desolation Canyon. For groundwater: GNBPA boundary.	Ongoing oil and gas development within the GNBPA may adversely impact hydrologic watersheds and groundwater, including water quantity and quality, wetlands, floodplains, and Waters of the U.S. Projects: Bonanza EA, Castle Peak and Eightmile Flat EIS, Monument Butte EIS, Gasco Uinta Basin EIS, Gasco Riverbend EA, Little Canyon EA, Hill Creek EA, Love Unit EA, Newfield Gusher EA, North Alger EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, RDG Uinta Basin EIS, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Greater Deadman Bench EIS, West Tavaputs Plateau EIS, Wilkin Ridge EA, Greater Chapita Wells Infill EIS, Southam Canyon EA, and ANF South Unit EIS.
Wilderness Characteristics	GNBPA and the entire BLM Vernal Field Office Management Area	Includes all non-WSA lands with wilderness characteristics identified by the BLM within the Vernal Field Office management area. Projects: Bonanza EA, Castle Peak and Eightmile Flat EIS, Monument Butte EIS, Gasco Uinta Basin EIS, Gasco Riverbend EA, Love Unit EA, North Alger EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, RDG Uinta Basin EIS, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Greater Deadman Bench EIS, Newfield Gusher EA, Little Canyon EA, Hill Creek EA, West Tavaputs Plateau EIS, Wilkin Ridge EA, Greater Chapita Wells Infill EIS, Southam Canyon EA, and ANF South Unit EIS. Existing and proposed pipeline projects within the BLM Vernal Field Office Management Area.
Wildlife and Fisheries Resources	GNBPA and the entire BLM Vernal Field Office Management Area	Includes most of the Uinta Basin greater sage-grouse population and parts of the Green and White rivers with designated critical habitat for the Colorado River endangered fish. This cumulative study area encompasses areas included within the USFWS Upper Colorado River Endangered Fish Recovery Program for which surface water depletions above a certain threshold are compensated for by payments to USFWS. Projects: Bonanza EA, Castle Peak and Eightmile Flat EIS, Monument Butte EIS, Gasco Uinta Basin EIS, Gasco Riverbend EA, Love Unit EA, North Alger EA, North Chapita EA, River Bend Unit Infill EA, Rock House EA, RDG Uinta Basin EIS, West Bonanza EA, Big Pack EA, Chapita Wells-Stagecoach EIS, Greater Deadman Bench EIS, Newfield Gusher EA, Little Canyon EA, Hill Creek EA, West Tavaputs Plateau EIS, Wilkin Ridge EA, Greater Chapita Wells Infill EIS, Southam Canyon EA, and ANF South Unit EIS. Existing and proposed pipeline projects within the BLM Vernal Field Office Management Area.



Township/Range

Greater Natural Buttes Project Area

Reasonably Foreseeable Development Areas

NAME

- Monument Butte - Red Wash
- West Tavaputs Plateau
- East Tavaputs Plateau
- Tabiona - Ashley Valley
- Altamont - Bluebell

N

3 1.5 0 3
Scale in Miles

4 2 0 4 8
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.2-1

Reasonably Foreseeable Development Areas

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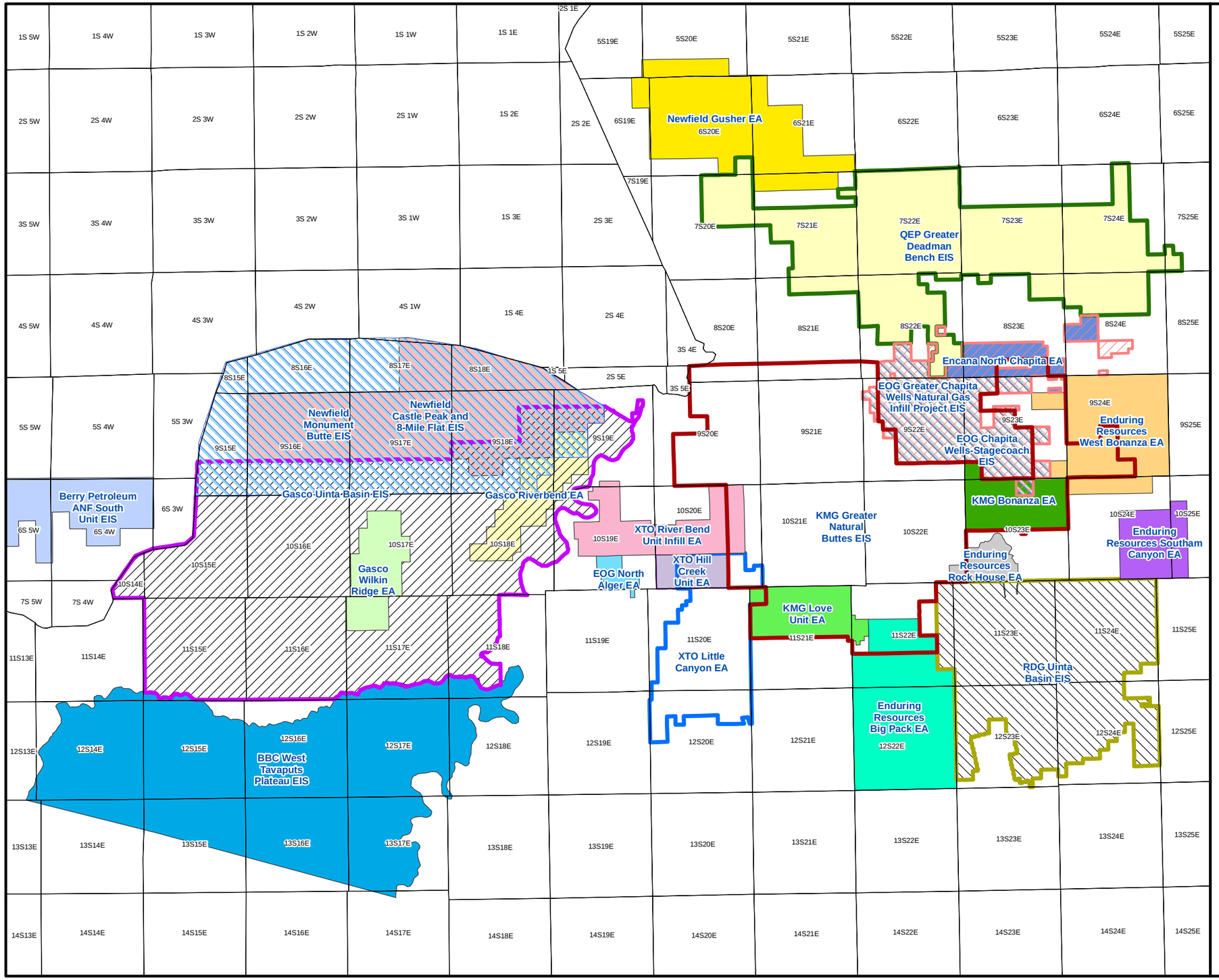

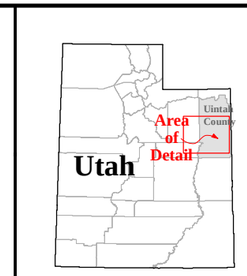

- Township/Range
- KMG Greater Natural Buttes EIS
- Newfield Monument Butte EIS
- BBC West Tavaputs Plateau EIS
- Berry Petroleum ANF South Unit EIS
- EOG Chapita Wells-Stagecoach EIS
- EOG Greater Chapita Wells Natural Gas Infill Project EIS
- EOG North Alger EA
- Encana North Chapita EA
- Enduring Resources Big Pack EA
- Enduring Resources Rock House EA
- Enduring Resources Southam Canyon EA
- Enduring Resources West Bonanza EA
- Gasco Riverbend EA
- Gasco Uinta Basin EIS
- Gasco Wilkin Ridge EA
- KMG Bonanza EA
- KMG Love Unit EA
- Newfield Castle Peak and 8-Mile Flat EIS
- Newfield Gusher EA
- QEP Greater Deadman Bench EIS
- RDG Uinta Basin EIS
- XTO Little Canyon EA
- XTO River Bend Unit Infill EA
- XTO Hill Creek Unit EA

N

3 1.5 0 3 6
Scale in Miles
5 3.75 2.5 1.25 0 5
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.2-2

Cumulative Actions Oil and Gas Field Development

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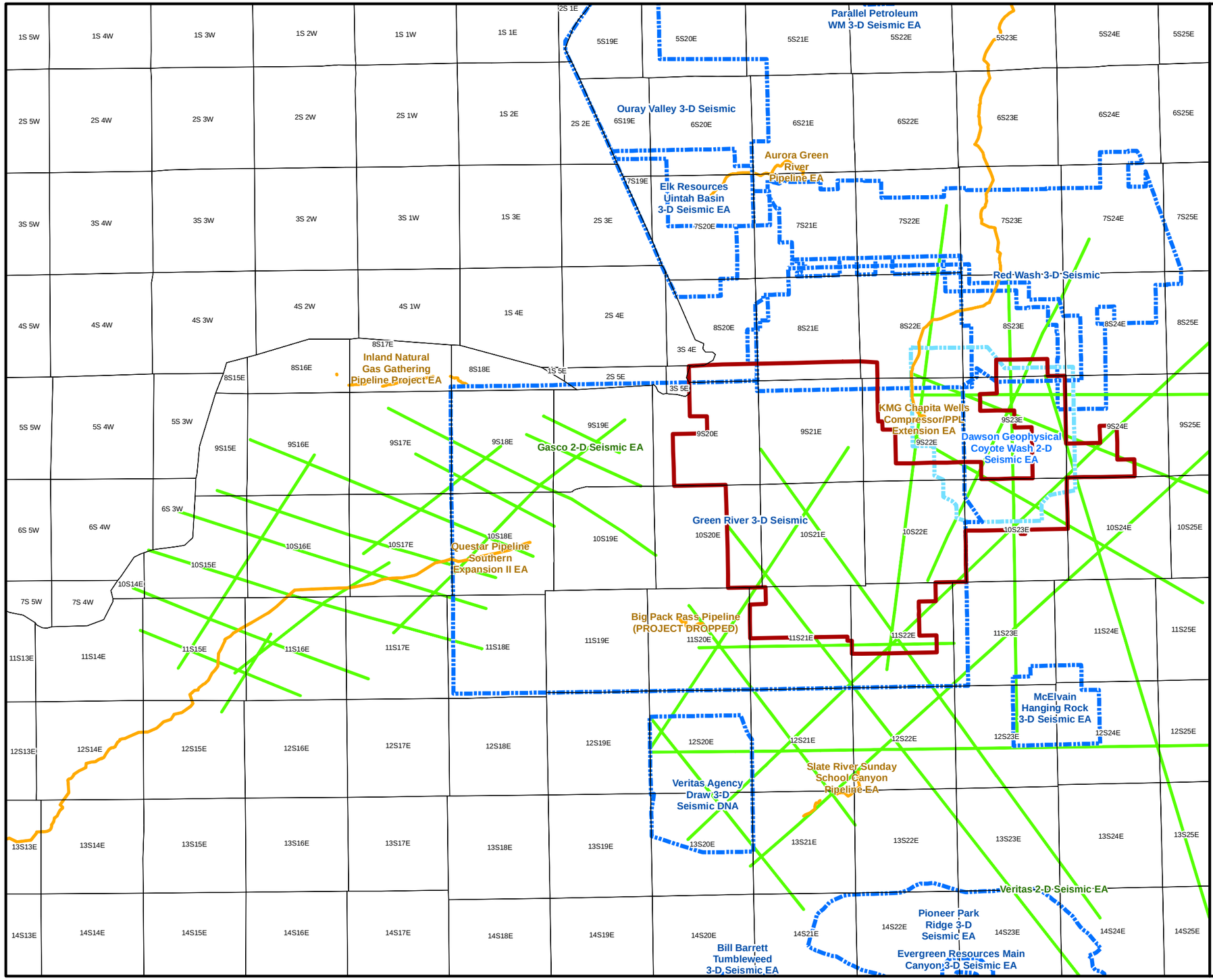

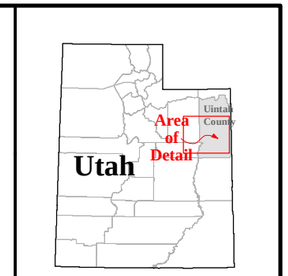

- Township/Range
- KMG Greater Natural Buttes EIS
- Pipeline Projects
- 3-D Seismic Project
- Dawson Geophysical Coyote Wash 2-D Seismic EA
- Linear 2-D Seismic Project

N

3 1.5 0 3 6
Scale in Miles

5 3.75 2.5 1.25 0 5
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.2-3

Cumulative Actions Seismic and Pipeline Projects

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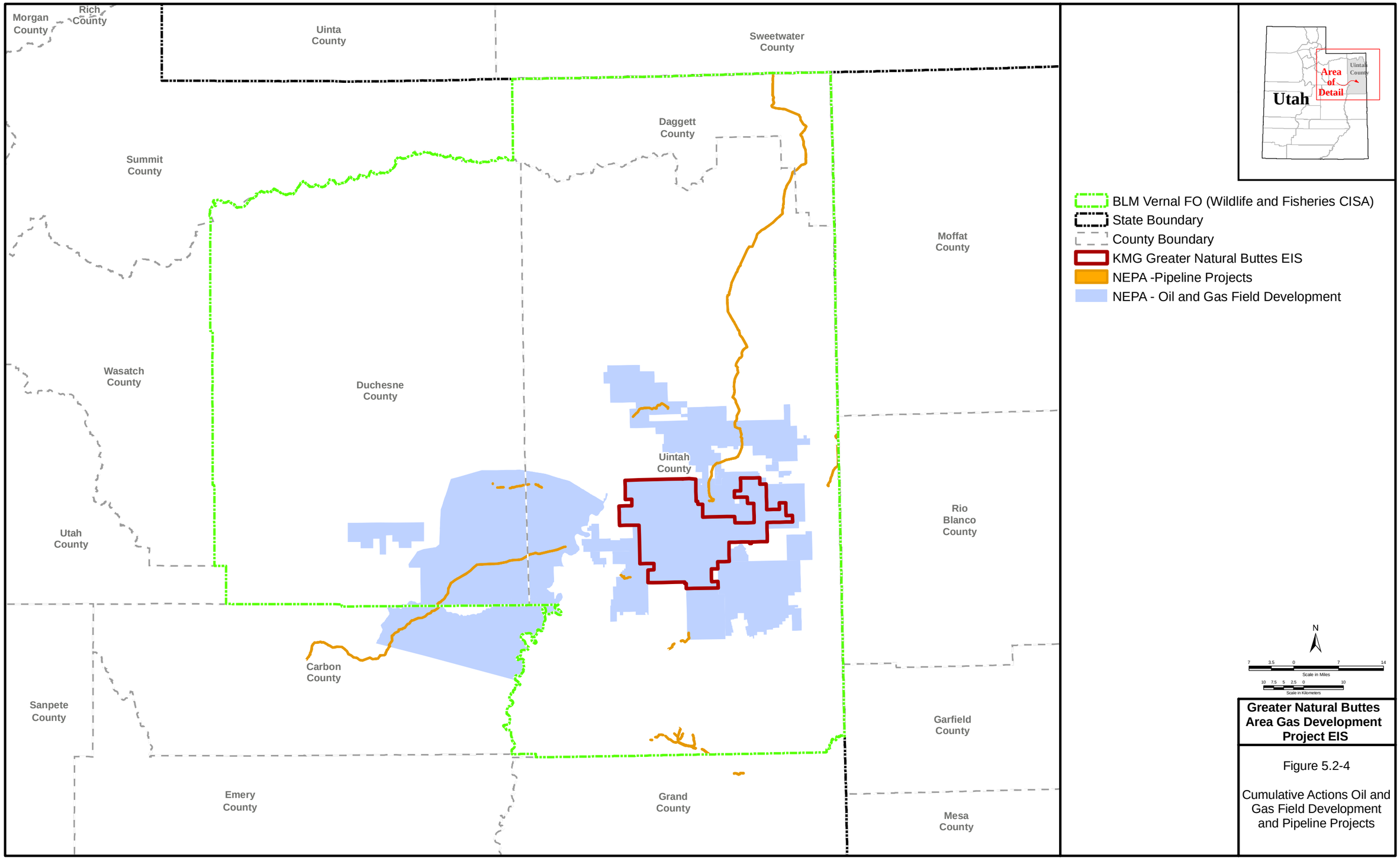

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.2-4

Cumulative Actions Oil and Gas Field Development and Pipeline Projects

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Table 5.2-2 Surface Disturbance Estimates for Past and Present Projects in the General Cumulative Effects Area

Project Name[1]	Total per Project			Outside the GNBPA			
	Wells (#)	Well Pads (#)[2]	Disturbance (acres)[3]	Fraction (%)	Wells (#)	Well Pads (#)	Disturbance (acres)
KMG Bonanza EA	95	95	877	0	0	0	0
Newfield Castle Peak and Eightmile Flat EIS	973	973	3,701	100	973	973	3,701
Gasco Riverbend EA	49	49	245	100	49	49	245
KMG Love Unit EA	125	125	706	5	6	6	35
Encana North Chapita EA	264	264	1,320	84	222	222	1,109
Enduring Resources Rock House EA	60	24	106	87	52	21	92
RDG Uinta Basin EIS	420	420	2,100	100	420	420	2,100
Enduring Resources West Bonanza EA	133	133	665	75	100	100	499
EOG Chapita Wells-Stagecoach EIS	627	627	1,735	86	539	539	1,492
QEP Greater Deadman Bench EIS	1,239	1,239	4,561	100	1,239	1,239	4,561
Newfield Gusher EA	75	75	375	100	75	75	375
Gasco Wilkin Ridge EA	54	54	270	100	54	54	270
Total Existing and Ongoing	**4,114**	**4,078**	**16,661**		**3,729**	**3,698**	**14,479**

[1] Information in this table was compiled from various notices and NEPA documents for each project.

[2] Number of well pads includes development of new pad locations and expansion of existing pads. If number of pads was not stated, all were assumed to be drilled vertically (i.e., one well per pad).

[3] Where disturbance estimates were not available, total project-related disturbance was estimated by assuming 5 acres per well pad.

Table 5.2-3 Surface Disturbance Estimates for Reasonably Foreseeable Projects in the General Cumulative Effects Area

Project Name[1]	Total per Project			Inside the GNBPA			
	Wells (#)	Well Pads (#)[2]	Disturbance (acres)[3]	Fraction (%)	Wells (#)	Well Pads (#)	Disturbance (acres)
Gasco Uinta Basin EIS	1,538	1,538	10,302	0	0	0	0
EOG North Alger EA	44	44	220	0	0	0	0
XTO River Bend Unit Infill EA	484	266	1,103	15	73	40	165
Enduring Resources Big Pack EA	664	292	1,620	13	86	38	211
XTO Little Canyon EA	510	362	1,882	6	31	22	113
BBC West Tavaputs Plateau EIS	807	538	3,656	0	0	0	0
EOG Greater Chapita Wells Natural Gas Infill Project EIS	7,028	1,679	5,688	14	984	235	796
Enduring Resources Southam Canyon EA	249	152	858	0	0	0	0
Berry Petroleum ANF South Unit EIS	400	400	2,000	0	0	0	0
Newfield Monument Butte EIS	5,750[4]	3,250	15,612	0	0	0	0
XTO Hill Creek EA	144	108	287	0	0	0	0
Total Other Pending Projects	**17,618**	**8,629**	**43,228**		**1,173**	**335**	**1,285**
KMG Greater Natural Buttes EIS (Proposed Action)	3,675	3,675	12,658	100	3,675	3,675	12,658
Grand Total Pending Projects	**21,293**	**12,304**	**55,886**		**4,848**	**4,010**	**13,943**

[1] Information in this table was compiled from various notices and NEPA documents for each project.

[2] Number of well pads includes development of new pad locations and expansion of existing pads. If number of pads was not stated, all wells were assumed to be drilled vertically (i.e., one well per pad).

[3] Where disturbance estimates were not available, total project-related disturbance was estimated by assuming 5 acres of disturbance per well pad.

[4] Of the 5,750 total wells, up to 3,250 would be oil wells and 2,500 would be deep gas wells.

For the general cumulative effects area, past, present, and reasonably foreseeable development is estimated by combining the number of well pads and surface disturbance associated with the following activities:

- The total existing (1,562 well pads and 7,766 acres; **Table 2.2-1**) and ongoing (1,102 well pads and 4,702 acres; **Table 2.4-1**) development within the GNBPA;
- The portion of the past and present development projects outside the GNBPA (3,698 well pads and 14,479 acres; **Table 5.2-2**); and
- The total reasonably foreseeable future oil and gas development projects (including the Proposed Action) within the general cumulative effects area (12,304 well pads and 55,886 acres; **Table 5.2-3**).

These activities add to a total of 18,666 well pads and 82,833 acres of disturbance in the general cumulative effects area. Some resources (e.g., range) are analyzed using a subset of the projects listed in **Tables 5.2-2** and **5.2-3**. The cumulative impact analysis for these resources was scaled accordingly based on the projects listed in **Table 5.2-1**.

For the most part, the projects listed in **Table 5.2-3** are located outside of the GNBPA. For those proposed projects that partially overlap into the GNBPA (River Bend Unit Infill EA, Big Pack EA, Little Canyon EA, and Greater Chapita Wells Infill EIS), the portion of each project within the GNBPA is estimated. Using this percentage, it is estimated that 335 additional well pads and 1,285 acres of disturbance would occur within the GNBPA in addition to the Proposed Action.

For those resources for which the CISA is the GNBPA only (cultural resources, Native American traditional values, geology, paleontology, soils, and vegetation), past, present, and reasonably foreseeable development is estimated by combining the number of well pads and surface disturbance associated with the following:

- The total existing (1,562 well pads and 7,766 acres; **Table 2.2-1**) and ongoing (1,102 well pads and 4,702 acres; **Table 2.4-1**) development within the GNBPA;
- The portion of the other reasonably foreseeable oil and gas development projects (excluding the Proposed Action) within the GNBPA (335 well pads and 1,285 acres; **Table 5.2-3**); and
- The Proposed Action (3,675 well pads and 12,658 acres; **Table 2.6-1**), the Resource Protection Alternative (3,675 well pads and 8,147 acres; **Table 2.7-1**), or the Optimal Recovery Alternative (13,446 well pads and 42,620 acres; **Table 2.8-1**).

These activities add to a total of 6,674 well pads and 26,411 acres of cumulative disturbance within the GNBPA for the Proposed Action Alternative; 6,674 wells pads and 21,900 acres for the Resource Protection Alternative; or 16,445 well pads and 56,373 acres for the Optimal Recovery Alternative.

Seismic surveys associated with oil and gas exploration are ongoing and expected to increase during the life of the project. According to the BLM Vernal RMP (BLM 2008c), 45 to 75 Notices of Intent (NOIs) to perform surveys are anticipated over the next 5 years. The majority of the oil and gas development activity is anticipated to occur in the Monument Butte-Red Wash exploration and development area. Most coalbed natural gas activity is expected to occur in the East and West Tavaputs Plateau areas.

5.2.1.2 Pipelines

Recently completed natural gas transportation pipeline projects include the Kanda Lateral and Mainline Expansion by the Wyoming Interstate Company (WIC) and the Southern System Extension II (SSXPII) by Questar Pipeline. The Kanda Lateral is a 24-inch, 124-mile pipeline that interconnects with the Natural Buttes Gas Field and moves gas to WIC's mainline at an interconnect near Rock Springs, Wyoming. The Kanda Lateral was placed in-service in January 2008. The Questar SSXPII project consisted of 55 miles of pipeline in the southern Uinta Basin. The project was placed in-service on November 1, 2007.

There are no reasonably foreseeable future pipeline projects in the general cumulative effects area (FERC 2009). It likely is that more major transportation pipelines would be built to provide natural gas producers with more market access and alleviate the chronic price differential between gas produced in the Rocky Mountain region as compared to gas produced in the Gulf Coast region. However, there presently are no major transportation projects that could be considered reasonably foreseeable.

5.2.2 Oil Shale

The study area is underlain by the Eocene-aged Green River Formation, which contains oil shale beds that are highly prospective for oil shale resources. The eastern Uinta Basin contains an estimated in-place resource of 214 billion barrels of oil (Trudell et al. 1983). Oil shale development has been speculative and highly dependent on oil prices. There have been several periods of optimism about the economic viability of the resource, the latest having occurred in the late 1970s and early 1980s. The oil price collapse in the mid to late 1980s repressed proposed oil shale development. The experimental White River oil shale mine was operated from 1974 to 1985 on 160 acres located in T10S, R24E on the south side of the White River (Oil Shale Exploration Company [OSEC] 2007), approximately 4 miles from the GNBPA east boundary. In 2005, the BLM issued a 160-acre lease to OSEC to conduct research and development pursuant to development of a commercial process to extract the oil resource. Phase I of the project began in July 2007, whereby previously mined stockpiled oil shale is being shipped to Canada for extraction under a proprietary process. Also during Phase I, the mine is being prepared for production. Phase II would include the development of a 250-ton per hour on-site processing facility, which OSEC expects to eventually increase to 500 tons per hour. Phase III, or full commercial production, would include development of multiple 250- to 500-ton per hour processing plants scattered on as much as 46,354 acres (pending acquisition of rights to mine). If developed to full capacity, the facility would produce 50,000 barrels of oil per day from a reserve estimated to be 2.7 billion barrels (OSEC 2007). No timetable was given, but commercial production would be expected to begin within the next 5 to 10 years depending on oil prices and commercial viability of the process.

A large portion of the GNBPA contains prospective oil shale lease areas as well as existing oil shale leases, but the tracts that potentially could be mined by OSEC are outside of the GNBPA. The reasonably foreseeable future oil shale activities would be those associated with Phase I described above. Phase II and III would still be considered speculative because they are predicated on the development of a commercially viable process. The BLM is evaluating leasing on other designated prospective oil shale lands, some of which are within the GNBPA. A draft of a national programmatic EIS was issued for public review in December 2007, which considers alternatives for leasing oil shale and tar sands (BLM 2008f). Depending on the outcome of the environmental analysis, oil shale leasing in the GNBPA is at least hypothetically possible, but no new leasing can occur unless Congress removes a moratorium on oil shale leasing (Snow 2008). Therefore, mining of oil shale in the GNBPA is not a near-term reasonably foreseeable activity.

5.2.3 Gilsonite

Gilsonite was first mined in the 1880s and production continues to the present (Notarianni 2008). **Table 5.2-4** lists the recent mining operations in the area. Although several of the small mine operations are inactive, all of the large gilsonite mine permits are active according to recent information from the UGS (Bon and Wakefield 2008, 2006). In 1961, a reported 470,000 tons of gilsonite was produced (Notarianni 2008). By 2004, only 63,600 tons were produced, which was an increase of 11,600 tons over 2003 (USGS and UGS 2004). The BLM (2002a) estimates that gilsonite production will continue to average approximately 60,000 tons per year over a 15-year period beginning in 2003, but the magnitude of production and likely amounts of disturbance are difficult to estimate. Authorized gilsonite leases are present in the GNBPA, but mining is occurring only at the Cottonwood mine.

Table 5.2-4 Permitted Gilsonite Mines, Uinta Basin

Name	Operator	Location (Section-Township-Range)	Within GNBPA	Type of Mine	Status
Bonanza	American Gilsonite Co.	23-9-24	No	Underground	Active
Cottonwood Mine	Lexco, Inc.	34-10-21	Yes	Underground	Active
Ziegler Gilsonite	Zeigler Chemical and Minerals Corp.	16-9-24	No	Underground	Active
Hardaway	Zeigler Chemical and Minerals Corp.	7-11-24	No	Underground	Inactive
ITM Mine	Lexco Inc.	25-10-20	Yes	Underground	Inactive
Neil State #1, #2 and #3	Zeigler Chemical and Minerals Corp.	32-11-24	No	Underground	Inactive
Tom Taylor Mine	Zeigler Chemical and Minerals Corp.	3-10-24	No	Underground	Active

Sources: Bon and Wakefield (2008, 2006)

Because of its occurrence as near-vertical dikes, historic mining of gilsonite has resulted in essentially open fissures that are a few feet wide or less and are continuous over long distances. The overall historical disturbance due to gilsonite mining is not known.

5.2.4 Tar Sands

Tar sands consist of heavy hydrocarbon residues, such as bitumen, from which volatile components have been lost. Oil can be liberated from these deposits by heating and other processes. In the Uinta Basin, tar sands appear to consist principally of degraded oil deposits along the basin margins. Extensive tar sand deposits in the basin have been classified into Special Tar Sand Areas (STSA) by the USGS and active mining occurs in the Asphalt Ridge STSA northwest of the GNBPA (Bon and Wakefield 2008, 2006). None of the STSAs overlaps the GNBPA, although the Chapita Wells minor tar sand deposit occurs in and adjacent to the north-central portion of the area. The Chapita Wells deposit is estimated to contain 7.5 to 8 million barrels of in-place bitumen (BLM 2002a). As discussed above, a programmatic EIS considering the leasing of prospective oil shale and tar sand deposits is in progress (BLM 2008f). Two STSAs are just to the south of the GNBPA and potential leasing and development of tar sand deposits would have effects on the general area. However, at this time, leasing and mining of tar sand deposits is not considered reasonably foreseeable for this analysis. The BLM (2002a) concluded that there is a low potential for development of the tar sand resource in the next 10 years.

5.2.5 Sand and Gravel

As discussed in Section 3.3, sand and gravel deposits may be present in the alluvial deposits within the GNBPA, but there are no current mining permits. It is possible that local deposits could be mined for use in road and location construction pursuant to the proposed gas field development activities, but the location and amount of disturbance cannot be estimated at this time.

5.2.6 Other Activities

Phosphate and uranium deposits are located in the general vicinity of the GNBPA, but there is low potential for development of these commodities in the general cumulative affects area (BLM 2002a). Other projects associated with recreation, livestock grazing, and vegetation treatments are anticipated to be implemented in the general vicinity of the GNBPA. However, the impacts from these projects are not quantifiable.

5.3 Cumulative Impacts by Resource

5.3.1 Air Quality

5.3.1.1 Cumulative Impacts of Criteria Pollutants

The Air Quality Technical Support Document (**Appendix G**) analyzed cumulative impacts to air quality from proposed oil and gas development and included other past, present, and foreseeable future projects in the CISA. Surface disturbance, drilling, completion, and operational activities resulting in effects to air quality in the GNBPA would contribute incrementally to those cumulative impacts analyzed for the CISA.

Most of the emissions in the Uinta Basin are associated with oil and gas exploration and production activities. **Table 5.3-1** contains a summary of the total emissions from oil and gas operations in the Uinta Basin for the year 2006.

Table 5.3-1 Summary of Emissions from Oil and Gas Operations in Uinta Basin – 2006

County	NO_X (tpy)	CO (tpy)	SO_X (tpy)	PM (tpy)	VOC (tpy)
Uintah	6,096	4,133	247	344	45,646
Carbon	995	814	22	40	2,747
Duchesne	3,053	2,448	96	173	19,019
Grand	337	207	16	22	2,360
Emery	273	199	9	14	453
Total	**10,754**	**7,800**	**391**	**592**	**70,226**

Table 5.3-2 compares the cumulative impacts, including the Proposed Action, to the NAAQS based on near-field dispersion modeling results. Cumulative impacts from criteria pollutants to ambient air quality are modeled to be well below the NAAQS at Class I areas and selected Class II areas.

Table 5.3-2 Cumulative Impacts Compared to NAAQS

Pollutant	Averaging Time	Proposed Action Maximum Predicted Impact ($\mu g/m^3$)	Background and Existing Source Impacts ($\mu g/m^3$)	Proposed Action plus Cumulative Sources Maximum Predicted Impact plus Background ($\mu g/m^3$)	Proposed Action as Percent of Cumulative	NAAQS ($\mu g/m^3$)
NO_2	Annual	2.53	13.17	15.70	16.1	100
CO	1-hour	270	6,325	6,595	4.1	40,000
	8-hour	175	3,910	4,088	4.3	10,000
SO_2	3-hour	0.85	18.34	19.19	4.5	1,300
	24-hour	0.39	10.48	10.87	3.6	365
	Annual	0.05	2.62	2.67	1.9	80
PM_{10}	24-hour	2.87	18.00	20.87	13.8	150
$PM_{2.5}$	24-hour	2.87	27.00	28.93	9.9	35
	Annual	0.34	7.00	7.34	4.6	15

5.3.1.2 Cumulative Impacts on Visibility

Since the Proposed Action emissions sources constitute numerous small sources spread out over a very large area, discrete visible plumes are not likely to impact the Class I areas, but the potential for cumulative visibility impacts (increased regional haze) is a concern. Potential changes to regional haze are calculated in terms of a perceptible "just noticeable change" (1.0 deciview) in visibility when compared to background conditions.

A 1.0 deciview change is considered potentially significant as described in the USEPA Regional Haze Regulations (40 CFR 51.300 et seq.), and originally presented in Pitchford and Malm (1994). A 1.0 deciview change is defined as approximately a 10 percent change in the extinction coefficient (corresponding to a 2 to 5 percent change in contrast, for a "black target" against a clear sky, at the most optically sensitive distance from an observer), which is a small but noticeable change in haziness under most circumstances when viewing scenes in mandatory federal PSD Class I areas.

It should be noted that a 1.0 deciview change is not a "just noticeable change" in all cases for all scenes. Visibility changes less than 1.0 deciview may be perceptible in some cases, especially where the scene being viewed is highly sensitive to small amounts of pollution. Under other view-specific conditions, such as where the sight path to a scenic feature is less than the maximum visual range, a change greater than 1.0 deciview might be required to be a "just noticeable change."

However, this NEPA analysis is not designed to predict specific visibility impacts for views in specific mandatory federal PSD Class I areas based on specific project designs, but to characterize reasonably foreseeable visibility conditions that are representative of a fairly broad geographic region, based on "reasonable, but conservative" emission source assumptions. This approach is consistent with both the nature of regional haze and the requirements of NEPA. At the time of a pre-construction air quality permit application, the applicable air quality regulatory agency may require a much more detailed visibility impact analysis. Factors such as the magnitude of deciview change, frequency, time of the year, and the meteorological conditions during times when predicted visibility impacts are above the 1.0 deciview threshold (as well as inherent conservatism in the modeling analyses) should all be considered when assessing the significance of predicted impacts.

The USFS, NPS, and the USFWS, published their "Final FLAG Phase I Report" (FLAG 2000), providing "a consistent and predictable process" for assessing the impacts of new and existing sources on AQRVs, including visibility. For example, the Final FLAG Phase I Report states, "a cumulative effects analysis of new growth (defined as all PSD increment-consuming sources) on visibility impairment should be performed," and further, "if the visibility impairment from the Proposed Action, in combination with cumulative new source growth, is less than a change in extinction of 10% [1.0 deciview] for all time periods, the Federal Land Managers (FLMs) will not likely object to the Proposed Action" (FLAG 2000).

The CALPUFF modeling cumulative analysis shows that non-project sources (2018 Projected Baseline sources) totally dominate the regional haze impacts on visibility at Class I areas. There would be no days with an incremental increase over the baseline above 1.0 deciview threshold for either the Proposed Action or the Optimal Recovery Alternative in Class I areas. For the Proposed Action, the maximum eighth highest value is 0.13 deciview (1.3 percent increase in extinction) at Arches National Park. For the Optimal Recovery Alternative, the maximum eighth highest value is 0.25 deciview, also at Arches National Park. At these levels, the incremental impacts from the Proposed Action or the Optimal Recovery Alternative would be virtually impossible to discern, and would not contribute to regional haze at the Class I areas.

The CALPUFF modeling indicates that the 2018 Projected Baseline emissions would result in impacts of 1.0 deciview for at least 201 days per year at the Class II areas. Modeling results for the Proposed Action at the listed sensitive Class II areas show discernible impacts at Flaming Gorge National Recreation Area and Dinosaur National Monument. Results predict an incremental impact of 102 days above 1.0 deciview (10 percent increase in extinction) at Flaming Gorge, and 32 days per year above 1.0 deciview at Dinosaur National Monument.

For the Optimal Recovery Alternative, incremental impacts are below 1.0 deciview at all Class I areas. At Class II areas under the Optimal Recovery Alternative, incremental visibility impacts are above 1.0 deciview at Flaming Gorge National Recreation Area and Dinosaur National Monument. However, FLM guidance does not provide visibility thresholds of concern for Class II areas.

5.3.1.3 Cumulative Impacts at Class I and II areas – Acid Deposition

The CALPUFF model system provides acid deposition results for sulfate and nitrate ion deposition at Class I and sensitive Class II areas, which are then used to analyze impacts to the acid neutralizing capacity of selected sensitive lakes in the modeling domain. Cumulative deposition from all modeled sources is below the established comparative deposition values for both alternatives at all Class I and Class II areas in the vicinity of the project. The Proposed Action and the Optimal Recovery Alternative contribute less than 1 percent to the acid deposition in Class I areas. At Flaming Gorge (a Class II area), the Proposed Action and the Optimal Recovery Alternative contribute 4.3 and 8.3 percent of the cumulative acid deposition, respectively.

The model shows that project-related impacts at sensitive lakes were below the USFS screening threshold for acid neutralizing capacity established for further analysis. Therefore, no additional analysis was conducted on these impacts.

5.3.1.4 Cumulative Impacts on Ambient Ozone Levels

Impacts on ambient air ozone were evaluated using the CMAQ model system. The modeling system meets the USEPA-established criteria for acceptable model accuracy and error statistics at the existing monitoring stations in the modeling domain. A model performance evaluation was conducted in accordance with USEPA guidelines (USEPA 2007). The evaluation compares actual monitored ozone data to modeled levels for a concurrent period. By incorporating the results of this evaluation, the model provides a means to compare the relative change in ambient ozone concentration between the project alternatives and baseline air quality. The model results show ozone levels below the current ozone standard of 75 ppb for the fourth highest annual level in the Uinta Basin for the Projected Baseline. For the Optimal Recovery Alternative, modeled ozone concentrations would be below the ozone standard of 75 ppb based on the 2005 meteorological data and below 79 ppb based on the 2006 meteorological data. The maximum fourth highest cumulative impact is 2.4 ppb from the Proposed Action scenario and 4.9 ppb from the Optimal Recovery Alternative. The Proposed Action ozone impact would be approximately 3.2 percent of the cumulative ozone impact within the Uinta Basin. The Optimal Recovery Alternative would contribute approximately 6.2 percent to the cumulative ozone impact. Results indicate that the Optimal Recovery Alternative may contribute to localized exceedences of the NAAQS for ozone.

5.3.2 Cultural Resources and Native American Traditional Values

The CISA for cultural resources is the entire GNBPA. Impacts from past, present, and reasonably foreseeable future actions within the CISA would be as discussed in Section 5.2.1.1. Given the average site density of 7.1 sites per square mile, approximately 293 sites could be located within accumulated disturbance areas for the Proposed Action, 243 sites for the Resource Protection Alternative, and 625 sites for the Optimal Recovery Alternative. It should be noted that sites are not evenly dispersed throughout the CISA, but typically are found in high potential areas such as juniper vegetation zones, sand dunes, or areas within 1 km of a permanent water source.

As directed by law, cultural resources inventories and consultations would be conducted for any projects involving federal lands, and adverse effects to NRHP-eligible sites would be avoided or mitigated as appropriate. All activities associated with the Proposed Action would be in accordance with federal laws and agency guidelines. Impacts to any previously unknown NRHP-eligible sites that may be discovered during construction activities would be mitigated in accordance with this EIS.

Although sites located within disturbance areas are avoided or mitigated, sites located outside of and adjacent to disturbance areas are vulnerable to indirect impacts such as vandalism, illegal collection, dust, and erosion. It is anticipated that there would be a cumulative increase in vandalism, illegal collection, and dust due to the increase in roads throughout the entire oil and gas field, and increased erosion at sites located in the vicinity of well pads and associated pipelines where vegetation cover has been reduced or eliminated.

5.3.3 Geology

For most geologic resources, the CISA is the GNBPA. For oil shale, the study area is the portion of the KOSLA within the GNBPA. Impacts from past, present, and reasonably foreseeable future actions within the CISA would be as discussed in Section 5.2.1.1. Extraction of oil and gas would irreversibly and irretrievably expend the resource, which would not be available for future use.

A large area of the southern Uinta Basin in the vicinity of the GNBPA is underlain by high quality oil shale with a perceived potential for development. Much of this area has been designated as KOSLA in recognition of this potential. Approximately 84 percent of the GNBPA is within a designated KOSLA. There are no active federal oil shale leases within the KOSLA, although there are numerous State of Utah active leases, including 38,000 acres within the GNBPA (BLM 2008f). There are no active oil shale extraction operations within the KOSLA and no existing or proposed NEPA approvals for such developments on BLM-managed lands. As oil shale extraction is not a currently foreseeable activity, there would be no additional cumulative impacts to oil and gas extraction resulting from oil shale development and no additional cumulative impacts to oil shale development from oil and gas extraction.

Cumulative impacts associated with geologic and mineral resources would be limited to current and foreseeable oil and gas development and continuation of ongoing gilsonite mining within the GNBPA.

5.3.4 Land Use

Oil and gas development has been prominent on the landscape in and around the GNBPA for many years and projections indicate that this trend is likely to continue. The CISA for land use is as defined on **Table 5.2-1**. Cumulative impacts to sensitive areas within the CISA includes the White River SRMA (2,831 acres).

Impacts within the White River SRMA would be caused by more human activity as well as increased surface disturbance. The applicant-committed measure to set back new wells 0.5 mile from the White River centerline within the White River viewshed would lessen project-related impacts. Topographic features and low-profile tanks also would help to obscure facilities from view. Although surface occupancy is not allowed in the BLM White River natural area, impacts to wilderness characteristics (i.e., naturalness, primitive and unconfined recreation, and solitude) would still occur due to an increase in human activity in the area.

In light of the minimal surface disturbance within the White River SRMA and the ACEPMs that would be implemented, cumulative impacts would be minimal.

5.3.5 Paleontology

For paleontological resources, the CISA is the GNBPA. Impacts to paleontological resources would result from direct surface disturbance of fossiliferous rocks, either through development activities or poaching. Impacts from past, present, and reasonably foreseeable future actions within the CISA would be as discussed in Section 5.2.1.1.

Approximately 84 percent (10,633 acres) of the disturbance associated with the Proposed Action would occur in areas underlain by the Middle Eocene Uinta Formation, which is considered to be of high paleontologic importance in the GNBPA (PFYC ranking of 4 or 5). Destruction of scientifically-important fossils would irreversibly and irretrievably damage the paleontological information base and those destroyed fossils would not be available for future analysis. None of the NEPA actions indicated in **Tables 5.2-2** and **5.2-3** would authorize development of other mineral resources and there would be no additional cumulative impacts to other paleontological resources from mineral development within the GNBPA. In addition to the potential for destruction of fossil resources, pre-construction surveys and other required mitigation measures typically required by the BLM would result in recovery of important fossils and expansion of the existing paleontological knowledge base.

5.3.6 Range Resources

The CISA for range resources as defined in **Table 5.2-1** includes the 12 grazing allotments listed on **Tables 5.3-3**, **5.3-4**, and **5.3-5** and illustrated in **Figure 5.3-1**. The cumulative impact assessment includes surface disturbances and water management activities associated with the proposed project as well as interrelated actions within the CISA.

Past, present, and reasonably foreseeable future actions within the CISA, excluding the proposed project, would result in the cumulative loss of approximately 25,295 acres from active grazing preference and associated 2,131 active AUMs as a result of surface disturbance activities within portions of each affected allotment. **Tables 5.3-3**, **5.3-4**, and **5.3-5** show the total cumulative impacts for each allotment under the Proposed Action, Resource Protection, and Optimal Recovery alternatives, respectively. As shown on **Table 5.3-3**, the Proposed Action would result in a disturbance of approximately 11,966 acres (1,018 AUMs). This would be approximately 32 percent of the total cumulative loss of 37,261 acres (3,149 AUMs). The incremental additional impacts to range resources as a result of the proposed project would be long-term in nature for the majority of the project disturbance area.

The Resource Protection Alternative incrementally would increase surface disturbance-related impacts to range resources in the CISA by approximately 7,702 additional acres (655 AUMs; **Table 5.3-4**), resulting in a total cumulative disturbance to range resources of 32,997 acres (2,787 AUMs). Impacts associated with the Resource Protection Alternative would represent approximately 24 percent of the total cumulative loss.

The Optimal Recovery Alternative incrementally would increase surface disturbance-related impacts to range resources in the CISA by approximately 40,290 additional acres (3,425 AUMs; **Table 5.3-5**), resulting in a total cumulative disturbance to range resources of 65,585 acres (5,556 AUMs). Impacts associated with the Optimal Recovery Alternative would represent approximately 62 percent of the total cumulative loss.

In addition to cumulative available forage and AUM loss, the development of access roads has had, and would continue to have, both adverse and beneficial impacts on the livestock grazing activities, range facilities, and resources. Range facilities including water sources, fences, cattle guards, and corrals, could be adversely impacted by construction and maintenance activities associated with proposed project and interrelated actions within the CISA. Water sources could be affected by the loss of access due to the placement and construction of new facilities, roads, and fences. Fences, cattle guards, and corrals could be damaged or destroyed by operation and maintenance activities, as well as the placement of permanent facilities.

Roads would provide additional access to portions of the allotments that currently do not have access. Roads also have the ability to increase livestock distribution in some areas, but also could disrupt distribution patterns. Increased livestock distribution would occur in some areas that have previously been inaccessible due to terrain limitations, distance from water, or a combination of both. Roads also would allow increased vehicular traffic, contributing to potentially adverse disturbance and increases in mortality to livestock from OHV users and those seeking dispersed recreational opportunities. Roads also would result in an increase in the spread of weeds. Specifically in the CISA, the spread of halogeton into disturbed areas would have impacts for livestock operators as it decreases native forage and can lead to livestock mortality. In addition, the new roads and utility ROWs would increase the fragmentation of grazing allotments, which would result in the reduction of native vegetative communities and decrease available forage.

Based on these direct and indirect cumulative impacts, past, present, and reasonably foreseeable future actions would cumulatively and incrementally reduce available acres from active grazing preference. This would reduce the associated available active AUMs for the lifetime of oil and gas development and production until such time that reclamation is deemed successful (approximately 10 to 50 years depending on the vegetation cover type).

Table 5.3-3 Cumulative Carrying Capacity Impacts per Allotment for the Proposed Action Alternative

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Impacts Without Proposed Project		Impacts from Proposed Action Alternative[2]		Cumulative Impacts Including Proposed Action Alternative		
			Acreage Disturbed	Active AUMs Lost[3]	Acreage Disturbed	Active AUMs Lost[3]	Acreage Disturbed	Active AUMs Lost[3]	Percent Active AUMs Lost[3]
BLM									
Antelope Draw	61,530	3,976	3,923	253	232	15	4,155	268	6.7
Coyote Wash	99,290	9,554	4,942	476	1,681	162	6,623	638	6.7
Olsen AMP	134,306	12,144	5,388	487	2,859	259	8,247	746	6.1
Sand Wash	75,136	7,974	4,397	467	3,988	423	8,385	890	11.2
Seven Sisters	19,285	2,348	2,469	300	669	81	3,138	381	16.2
Southam Canyon	13,827	1,357	264	26	29	3	293	29	2.1
Thorne-Ute Broome	5,436	400	197	12	6	1	203	13	3.3
White River Bottoms	12,900	885	97	7	42	3	139	10	1.1
BLM Total	**421,710**	**38,638**	**21,677**	**2,028**	**9,506**	**947**	**31,183**	**2,975**	**--**
BIA									
Cottonwood Wash	7,486	168	573	13	582	14	1,155	27	16.1
Molly's Nipple	10,742	400	872	32	818	30	1,690	62	15.5
Capita Grove	11,330	311	1,345	37	220	6	1,565	43	13.8
North White River	18,960	485	828	21	840	21	1,668	42	8.7
BIA Total	**48,518**	**1,364**	**3,618**	**103**	**2,460**	**71**	**6,078**	**174**	**--**
Grand Total	**470,228**	**40,002**	**25,295[4]**	**2,131**	**11,966**	**1,018**	**37,261[4]**	**3,149**	**--**

[1] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.
[2] Values taken from **Table 4.6-2**.
[3] Projected active AUMs lost and percent active AUM loss were calculated based on a percentage of the stocking rate within the surface disturbance-related impact area compared to the allotment stocking rate as a whole.
[4] Formal grazing allotments do not exist for 9,313 acres within the GNBPA; therefore, this value does not equal the total number of acres of new surface disturbance within the CISA for range resources.

Table 5.3-4 Cumulative Carrying Capacity Impacts per Allotment for the Resource Recovery Alternative

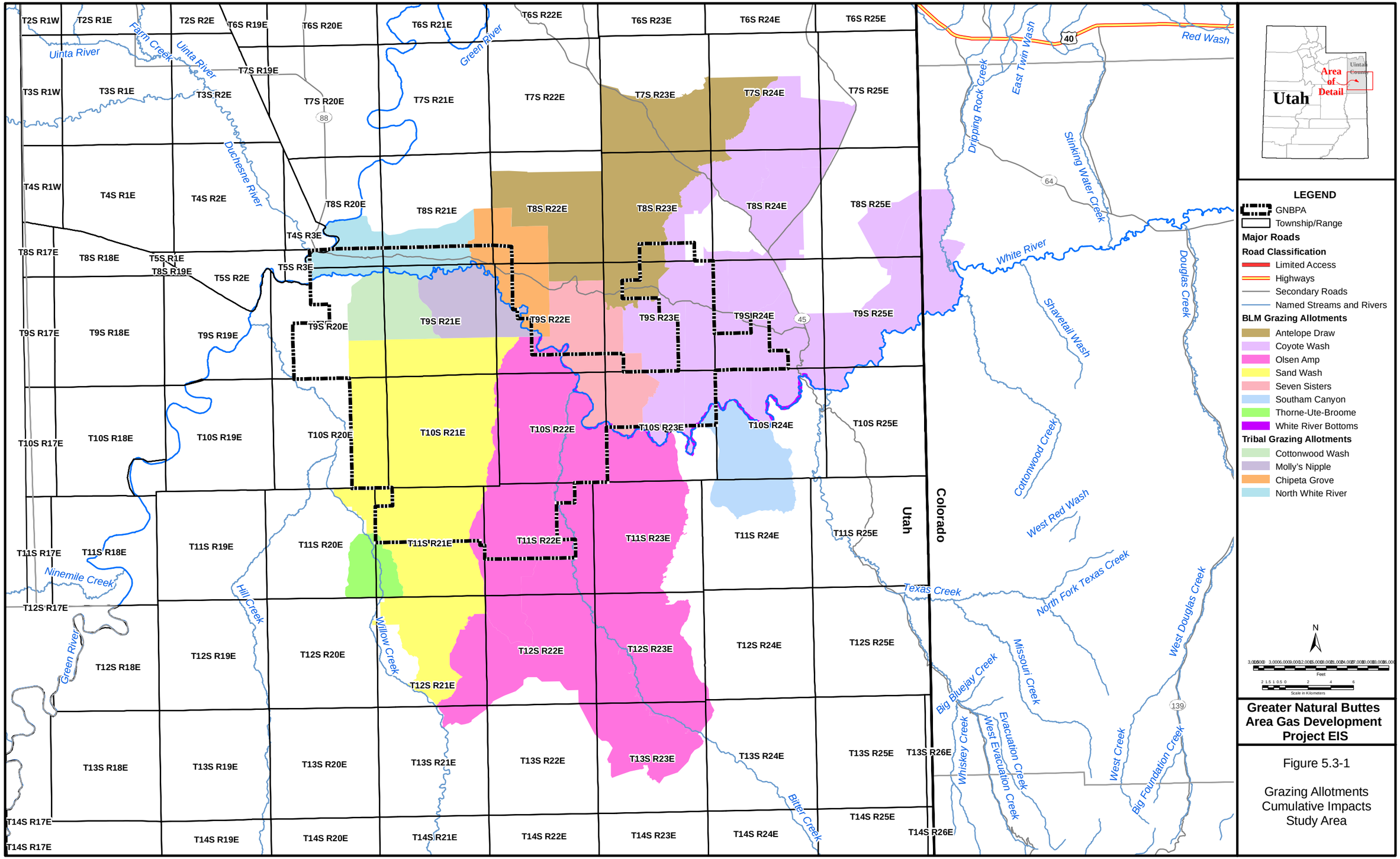
Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Impacts Without Proposed Project		Impacts from Resource Protection Alternative[2]		Cumulative Impacts Including Resource Protection Alternative		
			Acreage Disturbed	Active AUMs Lost[3]	Acreage Disturbed	Active AUMs Lost[3]	Acreage Disturbed	Active AUMs Lost[3]	Percent Active AUMs Lost[3]
BLM									
Antelope Draw	61,530	3,976	3,923	253	149	10	4,072	263	6.6
Coyote Wash	99,290	9,554	4,942	476	1,082	104	6,024	580	6.1
Olsen AMP	134,306	12,144	5,388	487	1,840	166	7,228	653	5.4
Sand Wash	75,136	7,974	4,397	467	2,567	272	6,964	739	9.3
Seven Sisters	19,285	2,348	2,469	300	430	53	2,899	353	15.0
Southam Canyon	13,827	1,357	264	26	20	2	284	28	2.1
Thorne-Ute Broome	5,436	400	197	12	4	≤1	201	12	3.0
White River Bottoms	12,900	885	97	7	27	2	124	9	1.0
BLM Total	**421,710**	**38,638**	**21,677**	**2,028**	**6,119**	**609**	**27,796**	**2,637**	--
BIA									
Cottonwood Wash	7,486	168	573	13	374	8	947	21	12.5
Molly's Nipple	10,742	400	872	32	526	20	1,398	52	13.0
Capita Grove	11,330	311	1,345	37	142	4	1,487	41	13.2
North White River	18,960	485	828	21	541	14	1,369	35	7.2
BIA Total	**48,518**	**1364**	**3,618**	**103**	**1,583**	**46**	**5,201**	**149**	**--**
Grand Total	**470,228**	**40,002**	**25,295[4]**	**2,131**	**7,702**	**655**	**32,997[4]**	**2,787**	**--**

[1] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.
[2] Values taken from **Table 4.6-4**.
[3] Projected active AUMs lost and percent active AUM loss were calculated based on a percentage of the stocking rate within the surface disturbance-related impact area compared to the allotment stocking rate as a whole.
[4] Formal grazing allotments do not exist for 9,313 acres within the GNBPA; therefore, this value does not equal the total number of acres of new surface disturbance within the CISA for range resources.

Table 5.3-5 Cumulative Carrying Capacity Impacts per Allotment for the Optimal Recovery Alternative

Grazing Allotment Name	Total Allotment Acreage	Total Allotment Active AUMs[1]	Impacts Without Proposed Project		Impacts from Optimal Recovery Alternative[2]		Cumulative Impacts Including Optimal Recovery Alternative		
			Acreage Disturbed	Active AUMs Lost[3]	Acreage Disturbed	Active AUMs Lost[3]	Acreage Disturbed	Active AUMs Lost[3]	Percent Active AUMs Lost[3]
BLM									
Antelope Draw	61,530	3,976	3,923	253	779	50	4,702	303	7.6
Coyote Wash	99,290	9,554	4,942	476	5,660	545	10,602	1,021	10.7
Olsen AMP	134,306	12,144	5,388	487	9,626	870	15,014	1,357	11.2
Sand Wash	75,136	7,974	4,397	467	13,429	1,425	17,826	1,892	23.7
Seven Sisters	19,285	2,348	2,469	300	2,252	274	4,721	574	24.4
Southam Canyon	13,827	1,357	264	26	98	10	362	36	2.7
Thorne-Ute Broome	5,436	400	197	12	21	2	218	14	3.5
White River Bottoms	12,900	885	97	7	142	10	239	17	1.9
BLM Total	**421,710**	**38,638**	**21,677**	**2,028**	**32,007**	**3,186**	**53,684**	**5,214**	--
BIA									
Cottonwood Wash	7,486	168	573	13	1,958	44	2,531	57	33.9
Molly's Nipple	10,742	400	872	32	2,754	102	3,626	134	33.5
Capita Grove	11,330	311	1,345	37	744	21	2,089	58	18.6
North White River	18,960	485	828	21	2,827	72	3,655	94	19.2
BIA Total	**48,518**	**1,364**	**3,618**	**103**	**8,283**	**239**	**11,901**	**342**	**--**
Grand Total	**470,228**	**40,002**	**25,295[4]**	**2,131**	**40,290**	**3,425**	**65,585[4]**	**5,556**	**--**

[1] An AUM represents the quantity of forage necessary to sustain 1 cow-calf pair or 5 sheep for 1 month.
[2] Values taken from **Table 4.6-6**.
[3] Projected active AUMs lost and percent active AUM loss were calculated based on a percentage of the stocking rate within the surface disturbance-related impact area compared to the allotment stocking rate as a whole.
[4] Formal grazing allotments do not exist for 9,313 acres within the GNBPA; therefore, this value does not equal the total number of acres of new surface disturbance within the CISA for range resources.



Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-1

Grazing Allotments
Cumulative Impacts
Study Area

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5.3.7 Recreation

The CISA for recreation is the GNBPA with a 2-mile buffer outside the boundary. Any decrease in recreation numbers within the BLM Vernal Field Office boundary could be attributed to oil and gas development. However, within the CISA, even though the Proposed Action would add 3,675 well pads to the GNBPA, the landscape already has been impacted by energy development over the decades. Adverse cumulative impacts to recreational resources within the CISA would include closures (both short- and long-term), restrictions as project development moved through its various stages, reduced recreational experiences due to noise and activity associated with oil and gas development, and a reduction in dispersed camping opportunities due to less available acreage. While a substantial portion of the CISA, including the White River, would be affected by industrial noise from oil and gas operations, the addition of wells from the proposed project would have a minimal cumulative impact to recreational activities within the CISA. Due to previous oil and gas development through the years, an extensive road network already is in place. These roads have reduced the value of primitive recreational activities in the area including naturalness, primitive and unconfined recreation, and solitude. Additional roads corresponding with new development would give even more access to potential recreational users, especially motorized recreation. Restrictions and closures during construction and development would impact recreationists in the short term, while the need for recreational users such as hunters to avoid areas that have been heavily developed would continue in the long term.

5.3.8 Socioeconomics

This section addresses the socioeconomic impact of the project alternatives when added to the past, present, and reasonably foreseeable future energy resource development in the two-county study area. Oil and gas development is the largest variable component of the RFDs and supports large segments of the regional economy. A study by the University of Utah (2007) estimated that the energy exploration and production industry supported nearly 50 percent of all jobs in the area in 2006; higher than, but reasonably comparable to, the 38 percent estimated as part of this assessment (Section 3.8). Energy exploration and production also is responsible for generating substantial public sector revenues that fund local public facilities and services and is a key driver affecting local population, demographic, and migration trends. Other historically and economically important segments of the regional economic base are agriculture, recreation, and tourism.

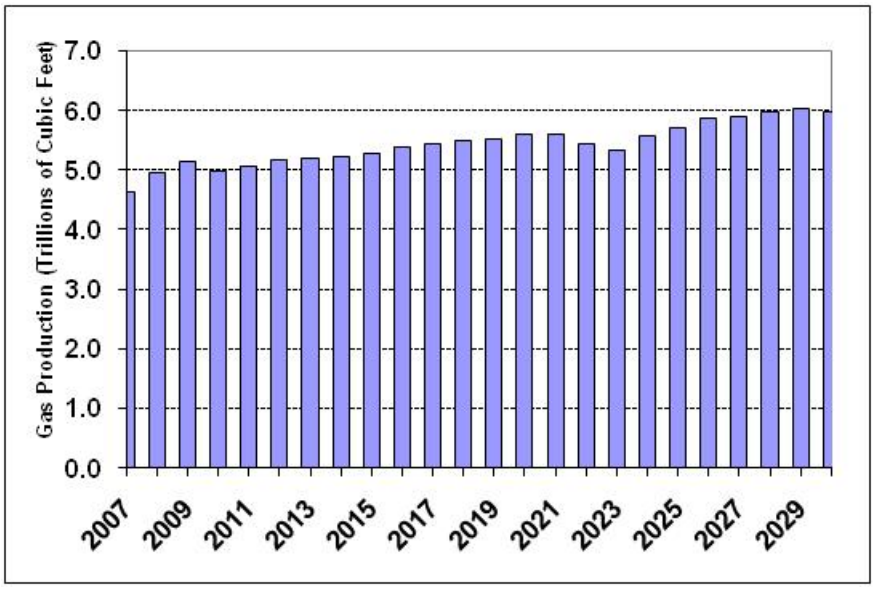
The cumulative effects of past and current development in the region are evident in the existing settlement patterns, physical development and infrastructure, fiscal structures, and social setting and networks in the region. Such development and related activities, events, and people associated with it, provide the area with its rich heritage and cultural history. Absent the area's energy resource endowments, the region likely would be much less developed and populated than it is today.

The collective cumulative activity has contributed to past growth and development and underlies important economic and social conditions and trends in the area. These trends include labor markets characterized by unemployment that is commonly below statewide levels, higher transient elements of the work force, competition and shortage of qualified labor, higher labor compensation costs, and population growth. Such growth provides much of the impetus for new residential and commercial development and expansion of local government infrastructure and services. Cumulative social effects also have occurred and energy resource development has resulted in some conflicts with recreation, tourism, and grazing on public lands. Cumulative impacts to recreation arise from fragmentation of contiguous areas available for outdoor recreation, changes in access, and development related traffic, dust and other factors that affect the quality of recreational experiences.

Future development by KMG would interact with other future activity to create similar cumulative effects. The Proposed Action is but one of several active and proposed oil and gas projects in the area. Prior to the onset of the current economic recession, more than 25 oil and gas drilling rigs were active in Uintah and Duchesne counties (Baker Hughes Inc. 2008). More than 500 wells were spud in Duchesne County in 2006 and 2007, with more than 1,350 additional wells spud in Uintah County during the same period. Weaker demand and lower commodity prices in 2008 and 2009 contributed to dramatic slowdowns in the rate of exploration and

development; the number of new wells spudded in the 2 counties was less than half the levels in the preceding 3 years.

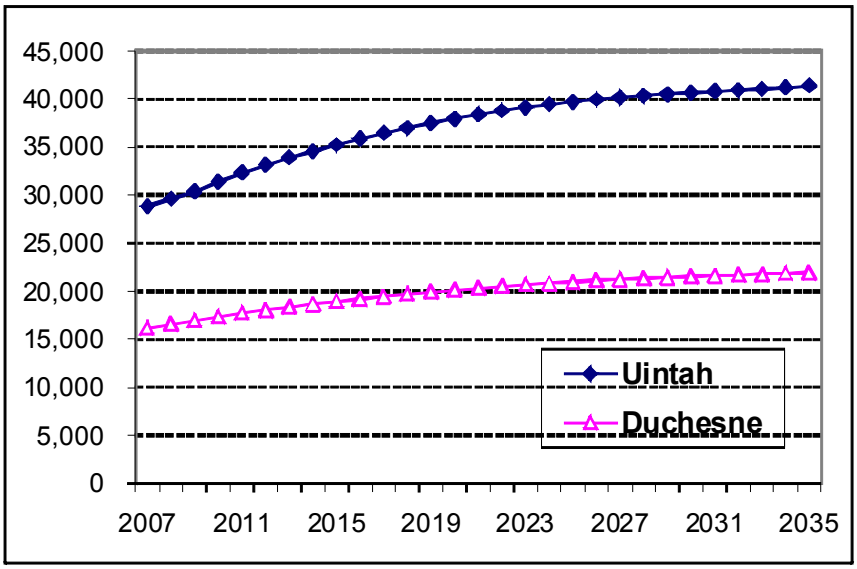
Despite the recent slowdown, long-term energy market forecasts call for higher prices and rising production for the Mountain region, encompassing Utah, North Dakota, South Dakota, Montana, Wyoming, Idaho, Nevada, Colorado, Arizona, and western New Mexico. Achieving the 20 percent growth in projected natural gas production by 2030, including the production needed to off-set declining production from existing wells, can be expected to stimulate renewed development in the Uinta Basin. As shown in **Figure 5.3-2**, the 6.07 Tcf of natural gas production over the life of the field for the Proposed Action is nearly equivalent to a single year's total production for the entire Mountain region. Alternatively, the average annual production under the Proposed Action would represent 3 to 4 percent of the annual regional production over the next two decades. Over the first 30 years of production, the average annual production for the Proposed Action also would represent approximately 40 to 45 percent of the 2008 gas production for the State of Utah (442 Bcf). Such development would be accompanied by investments in treatment, processing, compression, and transmission capacity to move the production to market.



Source: USDOE 2009.

Figure 5.3-2 Projected Natural Gas Production in the Mountain Region

Economic and demographic forecasts periodically prepared by the UGOPB, which considers future energy development activity, provide a perspective on cumulative growth in the region. The current projections, released in early 2008, were predicated on a slowdown in natural resource development extending through 2014, followed by a steady increase in natural resource related employment through 2027. Thereafter, natural resource employment is projected to decline, presumably due to declining levels of new development and stabilized or declining production from older wells. However, total employment based in Duchesne and Uintah counties is projected to increase by approximately 20 percent, topping 35,800 by 2035, and driving long-term population growth. The Proposed Action, projected to directly and indirectly support an average of 2,921 jobs during the development phase, would be a major source of economic activity and personal income in the region. Under the current forecasts, the 2 counties are projected to reach a combined population in excess of 63,000 residents by 2035; a 40 percent increase over the estimated 2007 population (**Figure 5.3-3**). It should be noted that, although the long-term projections portray a pattern of steady growth, future growth will in actuality be characterized by periods of more rapid growth and decline reflecting the scale and timing of cumulative actions.



Source: UGOPB 2008.

Figure 5.3-3 Projected Resident Population of Uintah and Duchesne Counties to 2035

Following the absorption of vacant housing, commercial and industrial development, and available capacities in public facilities, accommodating the future growth would require further residential and commercial development and expansion of public infrastructure. Public sector expenditures likely would increase in conjunction with infrastructure expansion and increases in staffing and services to meet higher demands. The level of development and employment associated with the Proposed Action would be among the major contributors to growth pressures over the next decade. Once development phase of the Proposed Action is completed, the incremental contribution attributable from the project would decline markedly in terms of employment, population, housing demand, and demands on public services, as other activities would be responsible for increasing shares of future growth.

The taxes, royalties and other public sector revenues associated with the Proposed Action would combine with those generated by other cumulative actions to help fund local governments, school districts, and the state government. Due to the vast federal, Tribal, and state lands in the area, energy resource development generates substantial revenues in the form of mineral lease royalties and severance taxes. Federal mineral lease royalties accrue to the federal and state government, and also benefit the Tribe. Severance taxes and royalties on production from state lands accrue to the state's coffers. Substantial ad valorem (property taxes) levied on the value of production as well as production, processing, and transportation equipment and facilities accrue to local entities, principally the counties and school districts. The 2007 University of Utah study reported more than $400 million in federal mineral royalties and lease bonus payments and $71.5 million in severance taxes on oil and gas production in Utah in 2006, the bulk of which were associated with activity in the Uinta Basin. Property taxes and royalties derived from production on state lands yielded nearly $54 million (University of Utah 2007). Oil and gas development generates sales and use taxes and other fees, both directly and indirectly, through the households and incomes supported by development and production.

Cumulative actions, including the Proposed Action, would continue to generate such revenues over the long term, although such revenues would fluctuate over time in response to changes in commodity prices and production levels. For this analysis, estimated public sector revenues were calculated based on a $6.00/Mcf average price of gas and $45 per barrel of condensates over the life of the field; actual revenues could be higher or lower depending on actual future prices. Project-related public sector revenues generated on future production, projected to exceed $6 billion over the life of the field, would continue for decades following the initial effects on population growth, housing, and demands on public facilities and services. More than

60 percent of these revenues would accrue to the benefit of the state's general fund, Permanent Community Impact Fund, Permanent Public School Fund, UDOT, Uintah County and the Uintah School District, and several other state agencies.

The nature of the cumulative economic and demographic impacts is subject to underlying uncertainties regarding the timing and pace of development of the various cumulative actions, which are in turn linked to factors including the availability of drilling capacity, labor force, natural gas transmission capacity, and capital to implement programs, as well as energy commodity prices and market demand. Potential outcomes include accelerated growth with higher population and demands on housing and services, or alternatively, sustained development activity over a longer time horizon resulting in future production characterized by a less pronounced peak and subsequent decline commonly associated with a single project.

Potential cumulative adverse economic impacts would occur in the areas of grazing and recreation. Impacts on grazing would occur as the combined effects of past and future energy resource development affect portions of one or more grazing allotments within the GNBPA, resulting in further reductions in grazing. Impacts on recreation would occur as the cumulative levels of development adversely affect the quality of the recreation experiences and potentially the level of recreation activity. These impacts could have slight incremental effects on the local tourism and outdoor recreation related industries; however, the timing, magnitude, and intensity of these effects are uncertain. The assessment in Section 4.8 noted the possibilities for potential jurisdictional mismatches between the growth in local tax bases in Uintah County while some population growth and demands on services would occur in Duchesne County and its communities. The prospect of future development in Duchesne County, along with recent and ongoing increases in the local tax base, could alleviate or lessen some of the fiscal mismatches.

Section 4.8 cited findings in Smith et al. (2001) that community well-being is often disrupted during resource development booms by the effect of waves of transient workers; landscape change; intrusion of industrial activity into recreational open space; and stress to local facilities, services, and institutions. While the pace of drilling is always subject to short-term variability, causing cycles of expansion and contraction in communities, a growing inventory of producing wells and field facilities can support workforces for a generation or longer. By enlarging the well base, development under the RFD potentially would add stability to the region's population. Though typically an order of magnitude smaller than the transient job waves accompanying drilling runs, a production workforce potentially invests and integrates in communities where there is industry employment.

5.3.9 Soils

The extent of the GNBPA defines the CISA for soil resources. Impacts from past, present, and reasonably foreseeable future actions within the CISA would be as discussed in Section 5.2.1.1. Past, present, and reasonably foreseeable future actions would cumulatively and incrementally increase disturbed soil acreages and reduce soil productivity for the lifetime of oil and gas development and production until such time that reclamation is deemed successful in terms of soil stability and soil productivity. Cumulative losses for soil resources could include accelerated soil erosion and soil loss and the reduced soil productivity as measured by amounts and types of vegetative cover and forage as well as BSC cover.

With implementation of the Proposed Action, cumulative impacts to soils from surface disturbance for past (existing), present (ongoing), and reasonably foreseeable (pending) projects within the GNBPA are projected to be 26,411 acres or 16.2 percent of the GNBPA (**Tables 2.2-1**, **2.4-1**, **2.6-1**, and **5.2-3**). The proposed 12,658 acres of new disturbance would represent approximately 48 percent of the 26,411 acres of cumulative disturbance anticipated under the Proposed Action.

Implementation of the Resource Protection Alternative would reduce the acres of cumulative disturbance and associated soil impacts to a total of 21,900 acres (13.4 percent of GNBPA); 4,511 acres less than disturbed under the Proposed Action (**Tables 2.2-1**, **2.4-1**, **2.7-1**, and **5.2-3**). The proposed 8,147 acres of new disturbance would represent approximately 37 percent of the 21,900 acres of cumulative disturbance anticipated under the Resource Protection Alternative.

Implementation of the Optimal Recovery Alternative would increase the cumulative soil disturbance to 56,373 acres (34.6 percent of the GNBPA); 29,962 acres more than disturbed under the Proposed Action (**Tables 2.2-1**, **2.4-1**, **2.8-1**, and **5.2-3**). The proposed 42,620 acres of new disturbance would represent approximately 76 percent of the 56,373 acres of cumulative disturbance anticipated under the Optimal Recovery Alternative.

Portions of past disturbances have been stabilized and revegetated with protective and productive vegetative cover. In some of these areas, BSCs have begun to recover in spaces between higher plants. Drought and other factors have contributed to reduced reclamation success for some areas of disturbance where reclamation measures were applied, but have failed to fully restore soil and plant cover and have slower BSC recovery to pre-disturbance conditions. Assessments of reclamation success have identified the key issues to be the lack of full restoration of vegetative cover and productive wildlife and livestock forage. Pending attainment of successful reclamation by higher plants and BSCs, the incremental additional impacts to soils as a result of the Proposed Action or other alternatives within the GNBPA would be long-term in nature for the majority of the GNBPA. Depending on reclamation requirements for ongoing and proposed projects, drought conditions and other factors may continue to affect reclamation success for those projects.

With the application of additional and specific measures to foster improved chances for success in stabilizing soils, enhancing potentials for successful re-establishment of protective vegetative and BSC cover as part of the proposed project, and with the continued efforts to improve the recovery of affected landscapes in the GNBPA, the rate of success for reclamation should improve (**Appendix E**). Soil stability and isolation of soil impacts to disturbed sites also would be addressed by the various SWPPPs for projects throughout the CISA. Reclamation measures would include those intended to optimize surface/slope stability, soil conditions (both physical and chemical/nutrient), seed mix composition and timely germination, BSC inoculation, and maintenance to resolve any soil conditions or revegetation issues prior to substantial impacts to either soil stability or higher plant and BSC cover re-establishment.

No cumulative impacts to soil resources would be expected from spills or releases of contaminants from activities associated with the proposed project since any spill or release would be contained and an approved clean-up process would be employed.

5.3.10 Transportation

The GNBPA has an extensive road network in place. Further expansion of this network to accommodate oil and gas development, as well as trails and roads to support recreational use, would have adverse as well as beneficial impacts. Adverse impacts would include an increase in project-related traffic and accidents within the GNBPA and primary access roads, as well as greater maintenance needs on new and existing roads as heavy truck traffic increases. A potential benefit would include an increased maintained road network that would cater to recreation as well as oil and gas development.

In areas where oil and gas development is already in existence, more dead-end roads would be built as additional wells are installed. Furthermore, as exploration moved into areas with less of an existing road network, arterial roads would be constructed in addition to dead-end roads. Project-related traffic on these roads would be greatest during construction, drilling, and completion phases; however, it is expected that use of telemetry would help to mitigate long-term traffic by enabling remote monitoring in some locations.

An increase in road construction would lead to greater recreational access for hikers, hunters, and OHV users, as access to areas such as the White River and the Book Cliffs becomes easier. With increased access by passenger vehicles comes an increased probability of accidents with large trucks that are utilizing the same roads.

5.3.11 Vegetation

The CISA for vegetation resources is defined as the GNBPA boundary. Impacts from past, present, and reasonably foreseeable future actions within the CISA would result in the loss of 7,766 acres for existing

projects; 4,702 acres for ongoing projects (**Table 4.11-1**); 1,285 acres for reasonably foreseeable oil and gas development projects (**Table 5.2-3**) and the additional acres of surface disturbance identified for the various action alternatives (Section 4.11, Vegetation). The cumulative loss of vegetation would be approximately 26,411 acres for the Proposed Action Alternative; 21,900 acres for the Resource Protection Alternative; and 56,373 acres for the Optimal Recovery Alternative. The Proposed Action Alternative would represent approximately 48 percent of the cumulative vegetation loss in the GNBPA, whereas the Resource Protection Alternative and Optimal Recovery Alternative would represent 37 percent and 76 percent, respectively, of the cumulative vegetation loss in the GNBPA. Past, present, and reasonably foreseeable future actions would cumulatively and incrementally reduce available vegetation cover types until such time that reclamation is deemed successful. Cumulative losses for vegetation resources potentially would include the reduction of numerous habitat functions including soil stability, erosion control, species biodiversity, wildlife forage and habitat, and available forage for livestock grazing operations.

Successful reclamation is defined as re-establishing a sustainable vegetation community that has similar species diversity and vegetative cover compared to similar undisturbed native vegetative communities. Successful reclamation is difficult in the Uinta Basin due to sustained drought conditions in the area, high percentage of soils with characteristics that limit restoration, and the presence of noxious and invasive weed species. It is estimated that successful reclamation would take at least 10 years, and would be potentially problematic in the desert shrub, and perennial grasslands/sagebrush communities (BLM 2008c). The desert shrub type is associated with shallow and highly saline soils, and has limited moisture availability. When oil and gas activities are combined with other surface disturbances such as grazing and chaining and burning activities, the perennial grasslands/sagebrush and pinyon-juniper communities are both highly susceptible to noxious weed invasions.

The BLM Vernal Field Office has yet to observe much reclamation success in the Uinta Basin. The recent multi-year drought conditions in the Uinta Basin area are believed to be the principal limitation to success for reclamation efforts. Based on the difficulties in reclamation success, the incremental additional impacts to vegetation as a result of the proposed project would be long-term in nature for the majority of the project disturbance area. The loss of mature trees and shrubs would be minimal relative to the total acreage of woody species communities that occur in the CISA. It is estimated that herbaceous-dominated plant communities would require a minimum of 10 years to establish adequate ground cover to prevent erosion and provide forage for wildlife species and grazing operations. Woody-dominated plant communities would require at least 25 to 50 years for shrubs of similar stature to recolonize the area. Re-establishment of mature pinyon-juniper woodlands would require 75 to 100 years.

Pipelines and seismic surveys such as those shown on **Figure 5.2-3**, have and would result in additional surface disturbance within the CISA. In addition, these linear projects have the potential to act as corridors for noxious weeds and invasive species to spread into the CISA.

In addition to cumulative vegetation loss, other impacts on vegetation likely would occur as a result of cumulative forage use by livestock, wildlife, and wild horses, affecting plant productivity and vegetation community structure and composition. Vegetation recovery may become even more difficult as livestock and wildlife compete for resources that are becoming less available due to surface-related impacts.

Indirect impacts to vegetation resources associated with surface disturbance-related activities may include soil loss and compaction, fugitive dust accumulation, and introduction and/or spread of noxious weeds and invasive species. Fugitive dust from development activities can adversely impact native vegetation communities and alter vegetative composition (USEPA 2008c; USFWS 2008b). Dust accumulation on plants has been shown to adversely affect a variety of plant functions including photosynthesis, respiration, transpiration, gas exchange and leaf conductance (USFWS 2008b). In addition, high dust accumulation can lead to partial defoliation, increased plant mortality, decreases in growth rates and vigor, and increase the spread of noxious weed and invasive species (USEPA 2008c; USFWS 2008b).

Noxious weeds and invasive species exist throughout the CISA already. Surface disturbance activities from the Proposed Action as well as other past, present and future projects have already and could further spread noxious weed and invasive species into previously undisturbed areas, and increase already established noxious weed and invasive species populations in both acreage and population numbers. Linear surface disturbances such as those associated with pipelines, roads, transmission lines and seismic surveys can and have provided corridors for further infiltration of noxious and invasive species (Gelbard and Belnap 2003; Watkins et al. 2003) into the GNBPA. The cumulative effect of multiple linear projects each with several miles of roads, transmission lines, pipelines, etc. can form networks on the landscape that invasive species can use to spread and establish. These networks of corridors can then serve as a source of propagules (D'Antonio et al. 2001) for noxious and invasive species to spread into adjacent undisturbed areas. Localized surface disturbances can and have facilitated the invasion of noxious and invasive species by removing native vegetative cover, creating areas of bare ground (Burke and Grime 1996; Watkins et al. 2003), and increasing light and nutrient availability (Stohlgren et al. 2003, 1999). Construction and operation activities associated with pipelines, transmission lines, oil and gas development and seismic surveys can aid in the mechanical transport of seeds from outside the CISA.

Fragmentation of the landscape by the cumulative impact of multiple linear and localized surface disturbances can impact native vegetative communities and native plant species. Impacts from fragmentation could include the loss of suitable habitat, the isolation of small populations, decreases in species densities, increased grazing pressure, more exposure to disturbances, increased competition, and decreased pollination. As landscape fragmentation increases the vulnerability of native vegetation communities, combined with increased sources of noxious weed and invasive species propagules and surface disturbances creating patches of bare areas, the potential for noxious weed and invasive species to spread and establish increases proportionately to the amount of disturbance.

Federal, state, and local regulations require management and control of noxious weed and invasive species. The severity of the threat posed by individual noxious weed and invasive species determines the amount of control required. Past, present and future projects including the Proposed Action would minimize the spread and establishment of noxious weed and invasive species through the implementation of noxious weed management techniques such as minimizing surface disturbance activities, the use of wash stations to control the mechanical spread of seeds, herbicide spraying of known populations, and the reclamation of disturbed areas.

5.3.11.1 Special Status Plant Species

Cumulative impacts to special status plant species would be increased due to number of other past, present, and reasonably foreseeable oil and gas development projects, pipelines, and seismic surveys in the CISA, and the associated direct and indirect impacts discussed above for general vegetation. Only the clay-reed mustard and the Uinta Basin hookless cactus were identified as having potential to occur within the CISA based on habitat requirements and known distribution.

Graham's beardtongue

Within the CISA, potential habitat of 121 acres for Graham's beardtongue is found in only one area and has minimal potential for overlap with most, if not all past, present, and reasonably foreseeable development activities. Due to the extremely limited distribution of this species, direct impacts from the Proposed Action and interrelated projects would be minimal. Indirect impacts, including effects from increased erosion, fugitive dust, increased spread and establishment of noxious and invasive species in potential habitat, and the loss of pollinators could increase slightly as a result of the Proposed Action and other past, present, and reasonably foreseeable development activities.

Clay-reed Mustard

Within the CISA, potential habitat of 322 acres for clay-reed mustard is found in only one location and has minimal potential for overlap with most, if not all past, present, and reasonably foreseeable development

activities. Due to the extremely limited distribution of this species, direct impacts from the Proposed Action and interrelated projects would be minimal. Indirect impacts, including effects from fugitive dust, increased spread and establishment of noxious and invasive species in suitable habitat, and road construction leading to increased access to isolated populations could increase slightly as a result of the Proposed Action and other past, present, and reasonably foreseeable development activities.

Uinta Basin Hookless Cactus

Cumulative impacts to Uinta Basin hookless cactus may be substantial due to overlap of development activities from past, present, and reasonably foreseeable projects within the CISA with extensive portions of the known range of the species. The cumulative long-term surface disturbance of Uinta Basin hookless cactus habitat within the CISA is shown in **Table 5.3-6**.

Table 5.3-6 Cumulative Estimated Surface Disturbance of Uinta Basin Hookless Cactus Habitat

Habitat[1]	Total Habitat Within CISA (acres)[2]	Estimated Cumulative Habitat Disturbed[3]					
		Proposed Action Alternative		Resource Protection Alternative		Optimal Recovery Alternative	
		Acres[4]	Percent	Acres[4]	Percent	Acres[4]	Percent
Uinta Basin hookless cactus	54,555	4,778	9	3,140	6	14,610	27

[1] Habitat identified based on modeling as described in Section 3.11.3.2, Uinta Basin Hookless Cactus.
[2] The CISA for vegetation resources is defined as the GNBPA boundary.
[3] Values include impacts associated with the project alternatives as well as other oil and gas development projects in the cumulative effects area (**Tables 5.2-2** and **5.2-3**).
[4] Due to the programmatic nature of this project, actual disturbance values were not available; therefore, a quantitative assessment was calculated as the sum of the acres of habitat impacted within the CISA by each project in the general cumulative effects area. The acres of habitat impacted in the CISA for each project was calculated as a percentage of habitat type within the project boundary multiplied by the actual surface disturbance associated with that project.

Cumulative effects to the cactus include direct and indirect impacts as discussed above for general vegetation. Direct impacts would result from the trampling and crushing of individuals, temporary or permanent removal of above ground cover, the temporary or permanent loss of suitable habitat, and soil compaction as the result of construction and operation activities, grazing, and recreational use.

Indirect impacts include habitat fragmentation, increased dust effects, introduction and spread of invasive species, temporary or permanent loss of suitable habitat, and changes to the composition of the native vegetative community from surface disturbance activities such as oil and gas development, grazing, road construction, seismic surveys, well staking, cultural resources surveys, biological surveys, and other human activities.

Changes in land use patterns or increased human encroachment also would adversely impact occupied and suitable habitats. In addition, recovery and reclamation of suitable habitats could be compounded by limiting reclamation conditions (e.g., drought).

5.3.12 Visual Resources

The CISA for visual resources (**Table 5.2-1**) consists of the VRM Class II areas within the GNBPA and the background distance zone viewshed (approximately 1,382,613 acres) of the proposed project (including views from the Duchesne, Green, and White rivers). The management directive for visual resources for the BLM-managed lands in the CISA is to comply with designated VRM class objectives. This directive does not apply to private lands, lands under the jurisdiction of the State of Utah, or lands owned by the Northern Ute Tribe. There are no visual resource management objectives or aesthetic protections for lands in the Uinta

Basin not managed by the BLM. Views to and from the Green River and White River are of particularly high sensitivity to visual intrusions and related contrasts.

Past, present, and reasonably foreseeable future oil and gas development in the CISA would have both direct and indirect cumulative impacts to visual resources. The addition of 12,658 acres of disturbance (22 percent of the total cumulative disturbance), fugitive dust, combustion emissions, drilling rigs, storage tanks, other ancillary structures, roads, pipelines, overhead electrical lines, OHV activities, and general upsurge of human use under the Proposed Action Alternative would increase the extent and magnification of visual contrasts and associated impacts. Cumulative impacts to VRM Class II lands would be minimal due to the exclusion of new well pads in the viewshed of the White River up to 0.5 mile from the river.

The Resource Protection Alternative would result in less disturbance, and therefore less cumulative visual impact, than the Proposed Action Alternative. The Optimal Recovery Alternative would result in more disturbance, and therefore more cumulative visual impact, than the Proposed Action Alternative.

5.3.13 Water Resources

The CISA for surface water consists of the Duchesne River, Pelican Lake – Green River, Cottonwood Wash – White River, Coyote Wash, Lower Pariette Draw, Agency Draw – Willow Creek, Sheep Wash – Green River, Asphalt Wash, White River, Bitter Creek, and Desolation Canyon hydrographic basins. Cumulative impacts to water resources and associated wetlands and floodplains would result from ongoing oil and gas developments, irrigated agriculture, livestock grazing, vehicular traffic, and other mining and industrial activities within the water resources CISA (**Figure 5.3-4**).

Surface water flows in the CISA are dominated by the Green River, which has an overall watershed area of approximately 35,500 square miles at Ouray, Utah. Contributions from the White River range from approximately 12 to 15 percent of the flows in the Green River at their confluence. High flows from the White River have become more important to the Green River system and related Colorado pikeminnow populations since flood control and withdrawals began at Flaming Gorge (Lentsch et al. 2000).

Smaller streams such as Pariette Draw Creek, Willow Creek, and Ninemile Creek likely contribute less than 5 percent overall to Green River flows through the CISA (Utah Board of Water Resources 1999). Based on these estimates, roughly 15 to 20 percent of the flow in the Green River through the CISA is contributed by the White River and these smaller watersheds where large areas of existing, ongoing, or proposed oil and gas projects are located. Additional cumulative impacts to water resources would occur from water uses and water quality constituent loads in runoff associated with oil and gas developments. The water demands by existing and reasonably foreseeable oil and gas development, and the population it supports form a large portion of overall water use in the CISA. However, it is substantially less than agricultural and other demands in the wider Uintah County region. The majority of water withdrawals for actual field development would create limited, short-term impacts to water quantities. With the estimate that approximately 15 to 20 percent of flows in the Green River through the CISA are contributed by study area watersheds where oil and gas development is concentrated, the cumulative impacts to water quantities in the river would be minor.

Investigations in the area indicate that water quality varies significantly. No stream or waterbody in the CISA is classified as a High Quality Water by the state. Beneficial uses for major streams in the region are similar to those identified for waterbodies in the GNBPA. Impaired waterbodies in the CISA, and the identified water quality constituents or factors that impair their designated beneficial uses, are shown in **Table 5.3-7**.

Table 5.3-7 Summary of Impaired Waterbodies Within the CISA

Watershed	Waterbody	Impaired Constituent(s)
Duchesne	Duchesne River	Salinity/total dissolved solids/chlorides
Lower Green – Desolation Canyon	Ninemile Creek	Temperature
	Pariette Draw Creek	Boron, salinity/total dissolved solids/ chlorides, selenium
Lower Green – Diamond	Pelican Lake	Temperature, pH
Lower White	none	None
Willow	Willow Creek	Total dissolved solids

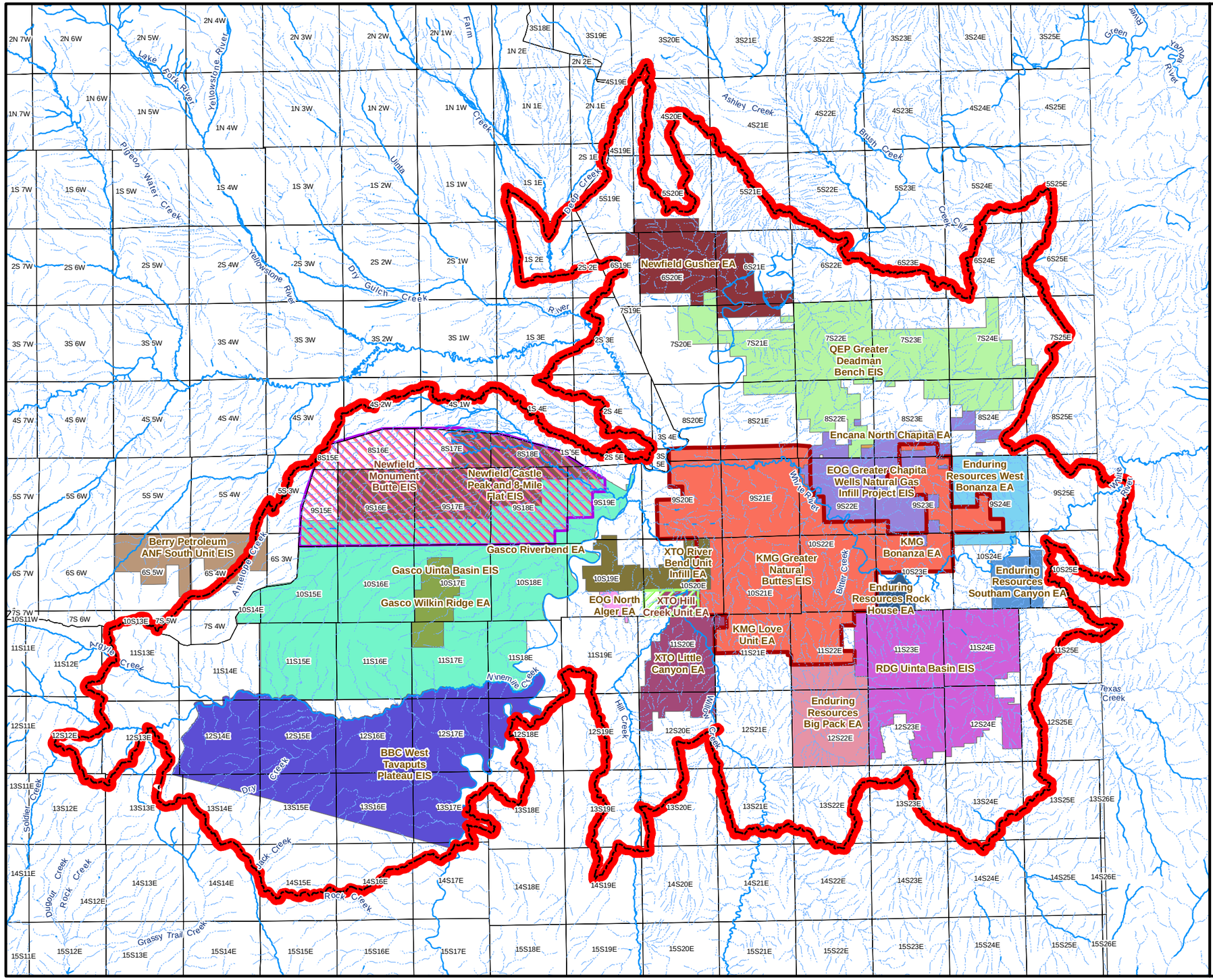
Source: Utah Division of Water Quality 2006.

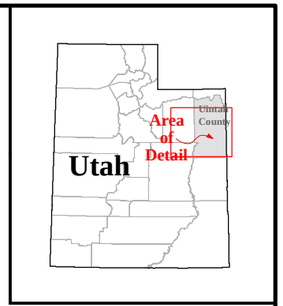
The White River, along with the Yampa River, Red Creek, Vermillion Creek, and other streams in the CISA, contributes a substantial amount of sediment and other water quality constituents to the Green River below Flaming Gorge Dam. Based on existing information (BLM 2008d,e,h), it appears that cumulative increases in sediment yield from oil and gas disturbance would represent less than 10 percent, and possibly less than 5 percent, of the average sediment load in the Green River upstream of Desolation Canyon. This would represent a noticeable but minor impact to water quality. Reviews of historical water quality data along the lower White River (Section 3.13.1.3) indicate that suspended sediment concentrations (as TSS) increase between Bonanza and Ouray, but there is no apparent relationship to increasing oil and gas disturbance in the CISA. This is likely to hold true for other watersheds in the CISA since it is more likely that changes in water quality from one sampling location to another in these semi-arid to arid watersheds result from natural geologic and geomorphic conditions, flows evaporating or seeping into the channel beds, and overall land use patterns.

Historical data indicate negligible to slight decreases in salinity (as TDS) in the lower White River over several decades of increasing oil and gas activity in the region. Similar to the suspended sediment concentrations, changes in reported salinity data may be more closely related to overall background conditions rather than strictly oil and gas disturbance. In addition, more extensive, long-term programs (e.g., the Colorado River Basin Salinity Control Program or implementation of Gold Book practices) may limit or reduce cumulative water quality impacts resulting from surface disturbance.

Increases in salinity and other water quality parameters also could occur as a result of spills, leaks, and seepage or “weeping” from abandoned wells. Most impacts from such incidents would be avoided or mitigated by compliance with environmental guidelines and prevention or cleanup programs. Without adequate plugging and abandonment, the potential for long-term seepage of saline groundwater from wells would represent a substantial potential impact to surface water quality within the CISA. The potential for this is discussed in an historical context in Chapter 3, Section 3.13.1.3. Plugging and abandonment of wells in accordance with Utah Oil and Gas Conservation General Rules R649-3-24 would avoid these impacts or reduce them to less than significant levels. Assuming that regulatory and operating programs are implemented properly, and that catastrophic failure of the produced water system or a storage facility does not occur, cumulative impacts to water quality in the CISA would be minor.

The CISA for groundwater is the GNBPA boundary. Cumulative impacts to groundwater could result from the continued injection of produced water under the No Action Alternative in combination with one of the action alternatives. Under the No Action Alternative, produced water would be managed primarily through evaporation, with approximately 15 percent being injected into the subsurface. As discussed in Section 4.13.1.3, most produced water is being injected into the Birds Nest aquifer, with minor amounts injected into deeper saline aquifers. Under both the Proposed Action and the Resource Protection Alternative, approximately 10,744,000 bbls of produced water would be generated per year by proposed project activities. A major portion (greater than 75 percent) of this produced water would be disposed of by injection into new disposal wells permitted by the USEPA, which is the authorizing regulatory agency for the UIC program on lands in the GNBPA.





- Water Resources Cumulative Impact Study Area
- Perennial Stream/River
- Intermittent Stream
- Township/Range
- Greater Natural Buttes Project Area
- BBC West Tavaputs Plateau EIS
- Berry Petroleum ANF South Unit EIS
- EOG Chapita Wells/Stagecoach EIS
- EOG Greater Chapita Wells Natural Gas Infill Project EIS
- EOG North Alger EA
- Encana North Chapita EA
- Enduring Resources Big Pack EA
- Enduring Resources Rock House EA
- Enduring Resources Southam Canyon EA
- Enduring Resources West Bonanza EA
- Gasco Riverbend EA
- Gasco Uinta Basin EIS
- Gasco Wilkin Ridge EA
- KMG Bonanza EA
- KMG Greater Natural Buttes EIS
- KMG Love Unit EA
- Newfield Castle Peak and 8-Mile Flat EIS
- Newfield Gusher EA
- QEP Greater Deadman Bench EIS
- RDG Uinta Basin EIS
- XTO Little Canyon EA
- XTO River Bend Unit Infill EA
- Newfield Monument Butte EIS
- XTO Hill Creek Unit EA

N

3 1.5 0 3 6
Scale in Miles

5 3.75 2.5 1.25 0 5 10
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-4

Water Resources CISA and Cumulative Actions Location Map

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As noted in Section 2.6.2.6, the proposed expansion of water disposal capacity would be more than adequate to accommodate the volume of produced water from the Proposed Action. The cumulative volume of produced water that would be injected includes the volume injected under the No Action Alternative, which currently is being accommodated by the existing injection capacity. Hence, the injection capacity within the CISA is anticipated to be adequate to handle the cumulative injection volumes. Under the Optimal Recovery Alternative, more produced water would be generated, requiring the installation of additional injection wells over and above that required by the Proposed Action.

Disposal of produced water under the UIC program is a highly regulated activity that provides for the protection of USDWs. Assuming compliance with UIC program regulatory requirements, cumulative injection of produced water within the CISA is not anticipated to impact other USDWs. This is due, in part, to the fact that injection activity can only take place where pre-existing groundwater quality (TDS greater than 10,000 mg/l) precludes other uses of the water. Due to the increased volume of produced water to be injected relative to the No Action Alternative, the injection plume within saline aquifers would be expected to increase in size due the increase in groundwater storage.

5.3.14 Wilderness Characteristics

The CISA for wilderness characteristics is the entire Vernal Field Office management area. Included in the cumulative impact analysis are all lands within the CISA found by the BLM to possess wilderness characteristics. These areas possess all of the values needed for wilderness including size, naturalness, and opportunities for solitude or primitive and unconfined recreation.

Of the 277,596 acres found to have wilderness characteristics within the CISA, 106,178 acres (38 percent) are protected, preserved, and maintained for their wilderness values as BLM natural areas (BLM 2008b). In accordance with management prescriptions in the Vernal RMP, these areas would remain in their current state. The remaining 171,418 acres (62 percent) do not have prescribed management to protect the wilderness values, and allows for uses that could degrade the wilderness characteristics of these areas.

Impacts to lands with wilderness characteristics could result from the past, present, and reasonably foreseeable future actions discussed in Section 5.2. **Figure 5.3-5** illustrates how these cumulative actions would overlap non-WSA lands with wilderness characteristics within the CISA.

5.3.14.1 BLM White River Natural Area

No cumulative effects would occur to BLM natural areas because no surface disturbance would occur within the BLM White River natural area under any of the proposed alternatives.

5.3.14.2 Non-WSA Lands with Wilderness Characteristics

Past, present, and reasonably foreseeable future projects would result in impacts to three areas of non-WSA lands with wilderness characteristics within the CISA (**Figure 5.3-5**). Excluding the proposed project, approximately 64,450 acres of non-WSA lands with wilderness characteristics would overlap with past, present, and reasonably foreseeable future projects outside of the GNBPA. This disturbance would impact the ability of the BLM to manage wilderness characteristics in these areas. The three areas that would be impacted and the projects that would impact them are as follows:

- **White River non-WSA lands with wilderness characteristics** would be impacted by projects including Enduring Resource's West Bonanza project, the RDG Uinta Basin project, and Enduring Resources Rock House Project.
- **Lower Bitter Creek non-WSA lands with wilderness characteristics** would be impacted by projects including Enduring Resources Big Pack project and the RDG Uinta Basin project.

- **Desolation Canyon non-WSA lands with wilderness characteristics** would be impacted by projects including the BBC West Tavaputs Plateau project and Gasco's Uinta Basin, Riverbend, and Wilkin Ridge projects.

Each of the proposed alternatives would impact the BLM's ability to preserve the wilderness values of the White River non-WSA lands with wilderness characteristics due to surface disturbance associated with the proposed activities impacting up to 2,786 acres. Therefore, the maximum cumulative impact to non-WSA lands with wilderness characteristics would total 67,236 acres, of which the proposed project would represent approximately 4 percent. These lands would no longer retain wilderness characteristics due to the additive and cumulative effects of oil and gas development.

As discussed above, 277,596 acres of inventoried lands in the Vernal Field Office management area were found to have wilderness characteristics, of which 171,418 acres were not carried forward for protection, preservation, and maintenance of wilderness values under the Vernal RMP. A total of 39 percent (67,236 acres) of this 171,418 acres would be foregone based on development of past, present, and reasonably foreseeable future oil and gas development in the CISA. Less than 2 percent (2,786 acres) of this 171,418 acres would result in the loss of wilderness characteristics due to the proposed development in the GNBPA.

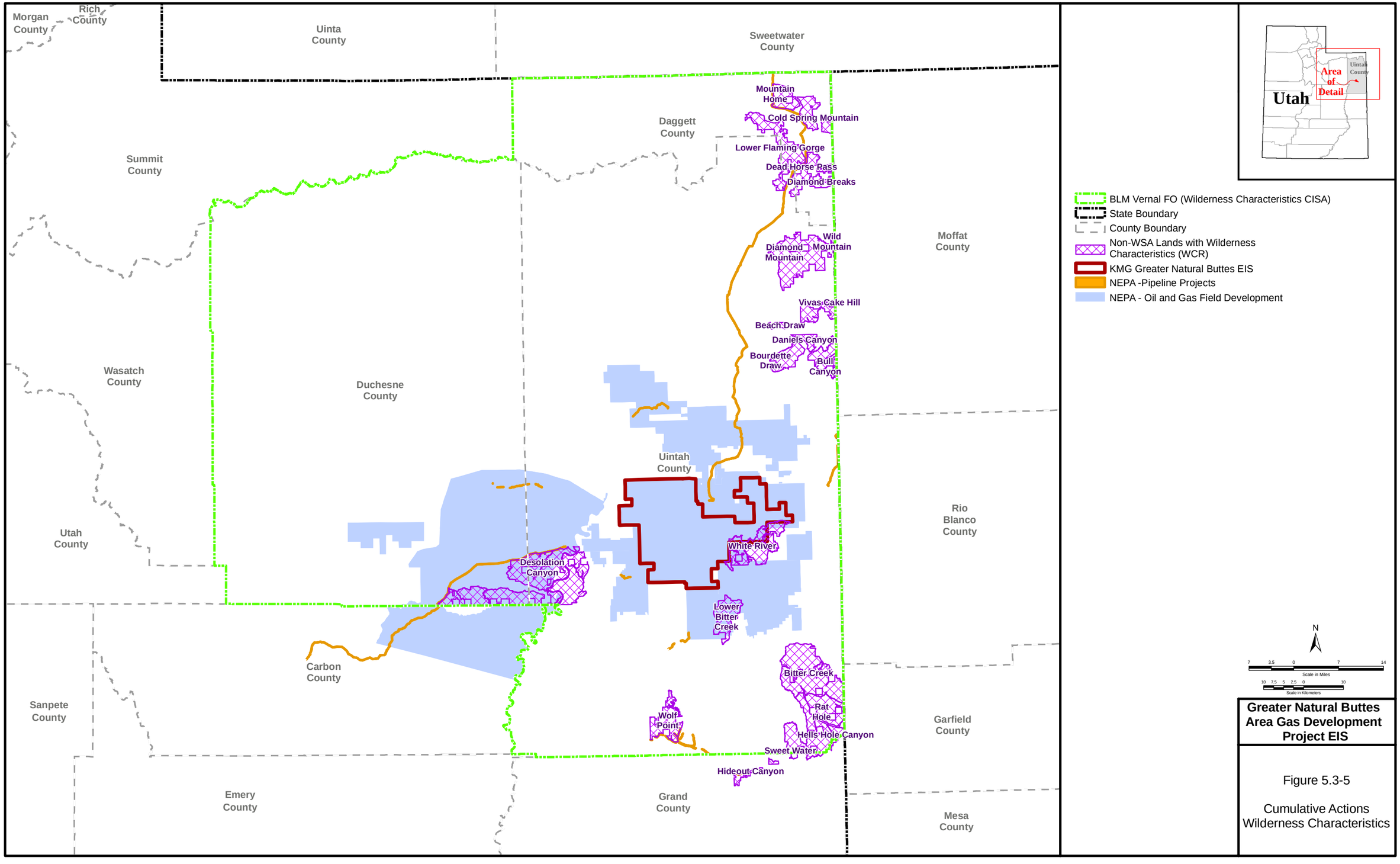
5.3.15 Wildlife and Fisheries Resources

The CISA for wildlife, fisheries, and special status species encompasses the entire BLM Vernal Field Office management area. The CISA extends from the Book Cliffs in the south, east to the Utah/Colorado border, north to the eastern Uinta Mountains (Utah/Wyoming border), and west to the edge of the Wasatch Mountain Range.

For wildlife, fisheries, and special status species, the cumulative analysis focuses on past, present, and reasonably foreseeable oil and gas development projects (**Tables 5.2-2** and **5.2-3**) and pipelines (**Figure 5.2-4**). The cumulative impact analysis focuses on the regional wildlife resources and how they may be susceptible to the cumulative actions identified for the proposed project assuming that: 1) human use of the CISA would increase with the implementation of the proposed project, 2) wildlife habitats currently are at their respective carrying capacities in and adjacent to the GNBPA, and 3) the overall region has been previously affected by historic and current oil and gas development activities.

5.3.15.1 Wildlife Resources

Cumulative impacts to wildlife resources primarily would be directly related to habitat loss, habitat fragmentation, and animal displacement. Long-term surface disturbance incrementally adds to wildlife habitat losses, overall habitat fragmentation, and animal displacement. In areas where oil and gas development has occurred, habitat fragmentation may have resulted in the disruption of seasonal patterns or migration routes. Historic, current, and future developments in the vicinity of the GNBPA have resulted, or would result, in the reduction of carrying capacities as characterized by the amount of available cover, forage, and breeding areas for wildlife species. Surface disturbance in the CISA primarily results from oil and gas development, including pipelines and seismic exploration. However, other activities such as livestock grazing, development of recreational facilities, and growth of Uinta Basin communities also contribute to cumulative impacts on wildlife and their habitats. Big game, especially pronghorn, would be most susceptible to these impacts since encroaching human activities associated with oil and gas development have resulted, or would result, in habitat loss and fragmentation and animal displacement in areas designated as crucial habitat (e.g., crucial winter habitat, fawning habitat). **Figures 5.3-6** through **5.3-10** display big game habitat within the CISA. Other wildlife species, such as raptor species, also would be susceptible to these cumulative impacts since encroaching human activities in the region resulted, or would result, in habitat loss and fragmentation and animal displacement in areas that may be at their relative carrying capacity for these resident species. Many of the local wildlife populations (e.g., small game, migratory birds) that occur in the CISA likely would continue to occupy their respective ranges and breed successfully, although population numbers may decrease relative to the amount of cumulative habitat loss and disturbance from incremental development.



Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-5

Cumulative Actions
Wilderness Characteristics

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Mesa County

Utah
Area of Detail
Uintah County

BLM Vernal FO (Wildlife and Fisheries CISA)
State Boundary
County Boundary
KMG Greater Natural Buttes EIS
NEPA -Pipeline Projects
NEPA - Oil and Gas Field Development

Pronghorn Habitat

Year-long crucial
Year-long substantial

N

7 3.5 0 7 14
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Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-6

Cumulative Actions
Pronghorn Habitat

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Uintah County

BLM Vernal FO (Wildlife and Fisheries CISA)
State Boundary
County Boundary
KMG Greater Natural Buttes EIS
NEPA -Pipeline Projects
NEPA - Oil and Gas Field Development

Mule Deer Habitat

Year-long crucial
Winter substantial
Winter crucial

N

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Scale in Miles
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Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-7

Cumulative Actions
Mule Deer Habitat

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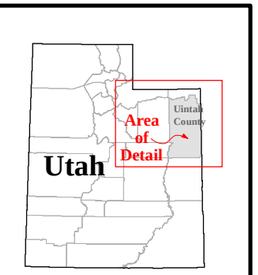

BLM Vernal FO (Wildlife and Fisheries CISA)
State Boundary
County Boundary
KMG Greater Natural Buttes EIS
NEPA -Pipeline Projects
NEPA - Oil and Gas Field Development

Elk Habitat

Winter crucial
Winter substantial

N

7 3.5 0 7 14
Scale in Miles

10 7.5 5 2.5 0 10
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-8

Cumulative Actions
Elk Habitat

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BLM Vernal FO (Wildlife and Fisheries CISA)
State Boundary
County Boundary
KMG Greater Natural Buttes EIS
NEPA -Pipeline Projects
NEPA - Oil and Gas Field Development

Rocky Mountain Bighorn Sheep Habitat

Year-long crucial

N

7 3.5 0 7 14
Scale in Miles

10 7.5 5 2.5 0 10
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-9

Cumulative Actions
Rocky Mountain Bighorn Sheep Habitat

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Grand County
Mesa County

Utah
Area of Detail
Uintah County

BLM Vernal FO (Wildlife and Fisheries CISA)
State Boundary
County Boundary
KMG Greater Natural Buttes EIS
NEPA -Pipeline Projects
NEPA - Oil and Gas Field Development
Bison Habitat
Year-long crucial

N

7 3.5 0 7 14
Scale in Miles
10 7.5 5 2.5 0 10
Scale in Kilometers

Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-10

Cumulative Actions
Bison Habitat

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Past, present, and reasonably foreseeable oil and gas development projects identified for the CISA, including the Proposed Action Alternative, have resulted, or would result, in the direct disturbance of approximately 82,833 acres. Approximately 15 percent of this cumulative impact would be attributable to the Proposed Action. Cumulative impacts under the Resource Protection Alternative would be approximately 4,511 acres less than under the Proposed Action Alternative and therefore, reduce impacts to wildlife. Cumulative impacts under the Optimal Recovery Alternative would be approximately 29,962 acres more than under the Proposed Action Alternative and therefore, would result in an increase in wildlife-related impacts. The Resource Protection Alternative and the Optimal Recovery Alternative would represent 10 percent and 38 percent, respectively, of the total cumulative surface disturbance in the CISA. **Table 5.3-8** presents cumulative long-term surface disturbance acreages for big game species under each alternative. A portion of the cumulative disturbance area has been, or would be, reclaimed or has recovered materially (i.e., wildfire areas). The reclaimed areas and areas associated with habitat conversion would be capable of supporting wildlife use (including big game); however, species composition and densities likely would change.

Table 5.3-8 Cumulative Long-term Surface Disturbance of Big Game Habitat

Species	Habitat[1]	Total Habitat Within CISA (acres)[2]	Estimated Cumulative Habitat Disturbed[3]					
			Proposed Action Alternative		Resource Protection Alternative		Optimal Recovery Alternative	
			Acres[4]	Percent	Acres[4]	Percent	Acres[4]	Percent
Pronghorn	Year-long Crucial	873,475	50,611	5.8	46,954	5.4	74,909	8.6
	Year-long Substantial	314,127	3,192	1.0	3,129	1.0	3,617	1.2
Mule Deer	Year-long Crucial	328,573	3,608	1.1	3,078	<1.0	7,131	2.2
	Winter Substantial	712,216	10,805	1.5	10,740	1.5	11,237	1.6
Elk	Winter Substantial	525,875	7,618	1.4	7,610	1.4	7,676	1.5
Rocky Mountain Bighorn Sheep	Year-long Crucial	1,115,392	8,279	<1.0	7,530	<1.0	13,258	1.2
Bison	Year-long Crucial	1,081,016	18,347	1.7	15,080	1.4	40,048	3.7

[1] Habitat designated by UDWR. Elk and mule deer data taken from the Final Vernal RMP.

[2] The Wildlife and Fisheries CISA encompasses the entire BLM Vernal Field Office Management Area and is approximately 5,518,859 acres.

[3] Values include impacts associated with the project alternatives as well as other oil and gas development and pipeline projects in the cumulative effects area (**Tables 5.2-2** and **5.2-3** and **Figure 5.2-4**).

[4] Due to the programmatic nature of this project, actual disturbance values were not available; therefore, quantitative assessment was calculated as the sum of the acres of habitat impacted within the CISA by each project in the general cumulative effects area. The acres of habitat impacted in the CISA for each project was calculated as a percentage of habitat type within the project boundary multiplied by the actual surface disturbance associated with that project.

While surface disturbance generally corresponds to associated wildlife habitat loss, accurate calculations of cumulative wildlife habitat loss cannot be determined because the direct impacts of habitat disturbance are species-specific and dependent upon: 1) the status and condition of the population(s) or individual animals being affected; 2) seasonal timing of the disturbances; 3) value or quality of the disturbed sites; 4) physical parameters of the affected and nearby habitats (e.g., extent of topographical relief and vegetative cover); 5) value or quality of adjacent habitats; 6) the type of surface disturbance; and 7) other variables that are difficult to quantify (e.g., increased noise and human presence). However, surface disturbance calculations are still a useful indicator of habitat loss because as forage, foraging and/or hunting habitats, and breeding, nesting, and rearing habitats are removed, overall quality of wildlife habitat also will decrease.

Indirect impacts associated with human presence and noise incrementally would increase in the CISA during the life of the proposed project. Indirect cumulative impacts from oil and gas development and other activities within the CISA would include:

- Animal displacement. Displaced individuals could be forced into less suitable habitats possibly resulting in subsequent effects of deteriorated physical condition, reproductive failure, mortality, and general distress as important habitat is reduced and animals are displaced. Loss of habitat/forage consequently could result in increased competition between and among species for available resources.

- Decreased reproduction success. A decrease in reproductive success and physical condition from increased energy expenditure due to physical responses to disturbance, which may lead to mortality.
- Increased traffic levels. An increase in traffic levels (associated with oil and gas development) on roadways has the potential to increase the risk of vehicle/wildlife collisions and increased human utilization of resources through hunting and other recreational activities that would expose wildlife to potential human harassment, either inadvertent or purposeful.

Based on these direct and indirect cumulative impacts, ongoing and future well development in the CISA would cumulatively and incrementally reduce the ability of wildlife habitats in the CISA to support wildlife and special status species at their current levels for the lifetime of oil and gas development and production (potentially 50 years). Cumulative impacts would continue until such time that reclamation is deemed successful (approximately 10 to 100 years depending on the vegetation cover type).

5.3.15.2 Fisheries Resources

Cumulative impacts to fisheries resources include erosion and sedimentation from surface disturbance, water depletion of the Green and White rivers from oil and gas activities and other land uses, and the potential for leaks or spills of contaminants from facilities or development activities within the Green River and White River watersheds.

Past, present, and reasonably foreseeable future actions in the CISA could result in some level of erosion and sedimentation, which in turn may impact aquatic habitats in localized areas. An increase of fine inorganic sediment in rivers and streams may impact fish spawning, fish rearing, and feeding behavior (USEPA 2003). Due to existing surface disturbance, ongoing projects, and poor reclamation success of previously disturbed areas, increased erosion and subsequent sediment yield are likely to occur locally within the Green River and White River watersheds.

Water depletions also may impact fisheries resources, including aquatic habitats, within the Green River and White River watersheds. Water requirements for drilling, hydrostatic testing, dust abatement, and other project activities have been or would be acquired from permitted sources. These sources may include direct withdrawals from the Green and White rivers, municipal sources, and local supply wells. Existing authorized water usage would directly and indirectly consume water from the Green and White Rivers and would ultimately cause reductions in flow within the Colorado River Basin. Many fish species are sensitive to water depletions and a reduction in surface flow, especially during the spawning period (USFWS 2002b,c,d,e).

Activities within or adjacent to the 100-year floodplains of the Green and White rivers or within drainages leading to these rivers may increase the potential for a release of contaminants into these drainages. Leaks or spills of contaminants may lead to habitat degradation and mortality of fish (Crist 2007). These potential cumulative impacts are discussed further in relation to special status fish species.

5.3.15.3 Special Status Species

Special status wildlife species also would be cumulatively affected by reasonably foreseeable oil and gas development and the resulting direct impacts discussed above for wildlife resources and fisheries resources; however, on BLM-managed lands, surveys typically are required in potential or known habitats of threatened, endangered, or otherwise special status species. These surveys would help determine the presence of any special status wildlife species or extent of habitat, and protective measures generally would be taken to avoid or minimize direct disturbance in these important areas. Given the status of the Uinta Basin greater sage-grouse population and the Colorado River endangered fish, cumulative impacts for greater sage-grouse, Colorado pikeminnow, razorback sucker, humpback chub, and bonytail may be more pronounced than for other special status species.

Greater Sage-grouse

Cumulative impacts to greater sage-grouse and their habitat would occur due primarily to disturbance associated with other nearby developments (oil and gas field development and pipelines) within the CISA (**Figure 5.3-11**). **Table 5.3-9** presents the cumulative long-term surface disturbance of greater sage-grouse habitat within the CISA.

Table 5.3-9 Cumulative Long-term Surface Disturbance of Greater Sage-grouse Habitat

Habitat[1]	Total Habitat Within CISA (acres)[2]	Estimated Cumulative Habitat Disturbed[3]					
		Proposed Action Alternative		Resource Protection Alternative		Optimal Recovery Alternative	
		Acres[4]	Percent	Acres[4]	Percent	Acres[4]	Percent
Nesting	108,267	4,029	3.7	3,381	3.1	8,329	7.7
Brooding	821,544	34,669	4.2	32,960	4.0	46,025	5.6
Wintering	225,453	14,628	6.5	13,328	5.9	23,267	10.3

[1] Habitat designated by UDWR.
[2] The Wildlife and Fisheries CISA encompasses the entire BLM Vernal Field Office Management Area and is approximately 5,518,859 acres.
[3] Values include impacts associated with the project alternatives as well as other oil and gas development and pipeline projects in the cumulative effects area (**Tables 5.2-2** and **5.2-3** and **Figure 5.2-4**).
[4] Due to the programmatic nature of this project, actual disturbance values were not available; therefore, quantitative assessment was calculated as the sum of the acres of habitat impacted within the CISA by each project in the general cumulative effects area. The acres of habitat impacted in the CISA for each project was calculated as a percentage of habitat type within the project boundary multiplied by the actual surface disturbance associated with that project.

Similar to the East Bench population, other populations of greater sage-grouse within the CISA have declined over the past 10 years (e.g., Deadman Bench, Halfway Hollow/12 Mile, Myton Bench). Most of these populations have experienced some level of habitat loss and fragmentation due to disturbance associated with oil and gas development, prolonged drought, overgrazing, and spread of noxious weeds. Based on the historic, existing, and proposed level of development that would occur within habitats occupied by greater sage-grouse within the CISA, it is likely that these populations would continue to experience habitat loss and fragmentation and, therefore, may exhibit further population declines.

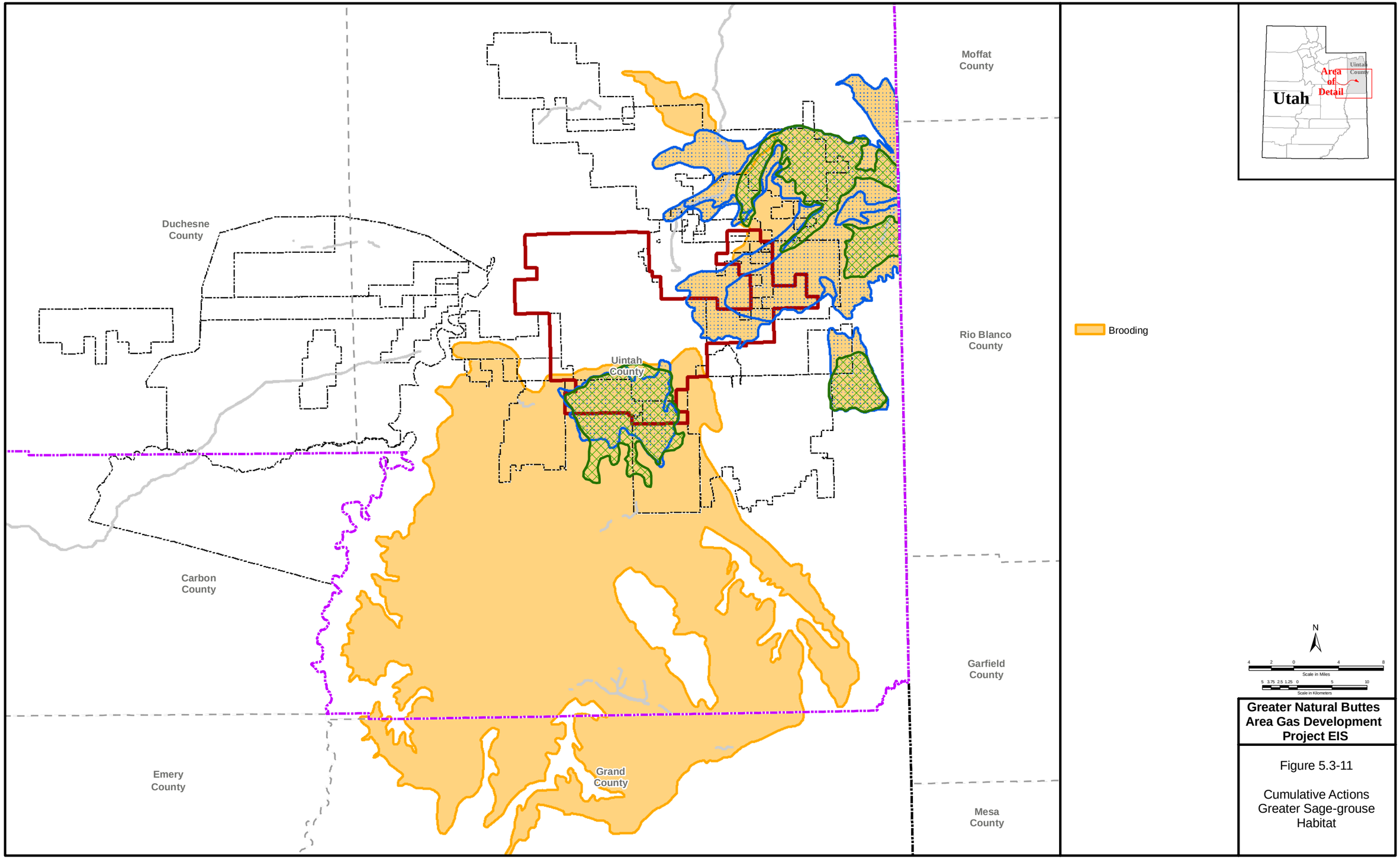
Colorado River Endangered Fish

The Colorado River endangered fish species (i.e., Colorado pikeminnow, razorback sucker, humpback chub, and bonytail) may be impacted by activities that deplete or degrade the flow of downstream waters of the Upper Colorado River Basin. Portions of the Green and White rivers that occur within the CISA provide habitat elements required by the Colorado River endangered fish. Cumulative impacts to these species include the erosion and sedimentation associated with nearby surface disturbance, the potential for spills or release of contaminants, entrainment in pumping devices (i.e., hoses, pumps, etc.), and consumptive water use.

The direct withdrawal of water from the Green and White rivers for development activities likely would increase the potential to impinge fish on intake screens. These potential impacts are similar to those outlined above for fisheries. In addition, the increased potential for release of natural gas condensate, hydrocarbons, or other toxic substances into the Green or White rivers or into tributary streams or drainages may cause direct mortality of individuals. Development activities in proximity to these aquatic resources within the CISA require special construction practices and spill prevention measures for projects that have the potential to impact the Green and White rivers.

Water requirements for drilling, hydrostatic testing, dust abatement, and other project activities would be acquired from permitted sources. These sources may include direct withdrawals from the Green and White rivers, municipal sources, and local supply wells. Water depletions from past, present, and reasonably foreseeable future actions in the CISA also may impact the Colorado River endangered fish within these

watersheds. Total water depletions of 757 acre-feet/year under the Proposed Action and Resource Protection alternatives and 1,385 acre-feet/year under the Optimal Recovery Alternative would constitute less than 1 percent of the total water depletions (182,603 acre-feet/year) within the White and Green rivers (USFWS 2009b).



Greater Natural Buttes Area Gas Development Project EIS

Figure 5.3-11

Cumulative Actions Greater Sage-grouse Habitat

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6.0 Consultation and Coordination

The CEQ regulations (40 CFR Parts 1500–1508) require an early scoping process to determine the issues related to the proposed action and alternatives that the EIS should address. The purpose of the scoping process is to actively acquire input from all interested parties to identify important issues, concerns, and potential impacts that require analysis in the EIS as well as to eliminate insignificant issues and alternatives from detailed analysis. The scoping process provides opportunities for the BLM, cooperating agencies, other interested parties, and the public to have meaningful involvement early in the decision-making process.

In coordination with the BLM and cooperating agencies, a Draft EIS is then developed and sent to all interested parties for public review and comment. Following a 45-day public comment period, all comments received are to be compiled and responses prepared for incorporation as an appendix to the Final EIS. The Draft EIS is then modified, clarified, and/or corrected as appropriate in coordination with the BLM and cooperating agencies. Once complete, the Final EIS is distributed to all interested parties for one final review and comment. Following this 30-day comment period, the BLM would develop a ROD and issue a ROW grant.

6.1 Agency Participation/Coordination

The BLM is the Lead Federal Agency for this EIS, which was prepared by the BLM Vernal Field Office in Vernal, Utah. A third-party contractor, AECOM Environment (AECOM), was used by the BLM to conduct studies, gather data, and prepare documents. Uintah County and the BIA have been designated as cooperating agencies. The BLM and cooperating agencies have been actively involved in preparing, reviewing, and creating the Draft EIS, as well as in developing mitigations to reduce impacts from the proposed project. Other federal, state, and local agencies were consulted throughout the process to address specific issues as needed.

The BLM conducted internal inter-disciplinary meetings as well as a public scoping meeting to solicit input and identification of environmental issues and concerns associated with the proposed project. A project kick-off meeting was held August 27, 2007, at the BLM facilities in Vernal, Utah. The kick-off meeting included the key BLM resource specialists, KMG representatives, and the third-party contractor (AECOM) project management team. The purpose of the kick-off meeting was to begin development of alternatives, establish the BLM interdisciplinary team communication protocol, discuss scheduling, identify preliminary sources of existing information, and review the status of the Project Description and other project information. Following this meeting, the BLM developed a Preliminary Interdisciplinary Team Analysis Record Checklist to assess the potential impact for the various resource areas (**Appendix C**). This Checklist is a “living” document and may be updated throughout the EIS preparation process, which terminates with the issuance of the ROD by the BLM.

The following Tribes, agencies, and organizations/individuals were contacted during the scoping process for input regarding potential concerns in the project area.

Tribes:

Ute Mountain Ute

Confederated Tribes of the Goshute Reservation

White Mesa Ute Council

Laguna Pueblo

Southern Ute Tribal Council

Ute Indian Tribe

Santa Clara Pueblo

Hopi Tribal Council

Zia Pueblo

Navajo Nation

Northwestern Band of Shoshone Nation

Eastern Shoshone Business Council

Federal Agencies:

Advisory Council on Historic Preservation

Army Corps of Engineers

Bureau of Indian Affairs

Natural Resources Conservation Service

U.S. Environmental Protection Agency

U.S. Fish and Wildlife Service

State Agencies:

Utah Department of Environmental Quality

Utah Department of Transportation

Utah Division of Oil, Gas, and Mining

Utah Division of Water Resources

Utah Division of Wildlife Resources

Utah School and Institutional Trust Lands Administration

Utah State Historic Preservation Office

Local Agencies:

Uintah County Road Department

Organizations:

Southern Utah Wilderness Alliance

Utah Natural Heritage Program

Refer to Section 1.5 for further discussion regarding participation and coordination with other agencies during development of this EIS and during the permitting process. A summary of the consultations to date for Section 7 of the ESA and Section 106 of the NHPA are included in **Table 6.1-1**.

Table 6.1-1 Status of Section 7 and Section 106 Consultation

Agency Consulted	Status Summary to Date
USFWS	A letter requesting to initiate consultation and requesting information on the project was sent on October 25, 2007. The USFWS responded on November 30, 2007, and it was agreed that the EIS for the project would include adequate information and analysis to serve as the Biological Assessment for the project. The USFWS has reviewed and commented on both the administrative draft and the preliminary draft EIS and all comments have been taken into consideration in the preparation of the Draft EIS. Ongoing discussions continue regarding the USFWS primary concerns for potential impacts to threatened and endangered fish species and the Uinta Basin hookless cactus.
Utah SHPO	In the summer and fall of 2008, a Class III (field survey) inventory was conducted of remaining portions of the GNBPA that had not been previously surveyed. The results are in the process of being compiled and combined with previous inventories conducted in the GNBPA into one report for the proposed project. Once completed, the Class III inventory report will be submitted to the BLM Vernal Field Office and the Utah SHPO for review.
Native American Tribes	The BLM initiated government-to-government consultation on January 9, 2008, by sending letters to 12 Tribal groups. Three of the contacted Tribes have responded to date. The Pueblo of Laguna and Navajo Nation indicated that the proposed project would have no significant impact on any traditional cultural properties or historic properties of importance to the Tribes. The Navajo Nation requested notification of any unanticipated discoveries unearthed during the course of the project, and the Pueblo of Laguna requested notification in the event any new archaeological sites are discovered and artifacts are recovered. The Hopi Tribe expressed concern with stone cairn sites previously documented in the GNBPA. At the request of the Hopi, the BLM and Director of the Hopi Office of Cultural Preservation visited several of the stone cairn sites in the GNBPA. The Director currently is preparing a report that will summarize the field visits, provide cultural affiliation and function of the sites, and indicate whether additional site visits are needed.

The following Tribes, agencies, and organizations/individuals have received a copy of the Draft EIS or have been notified that the public Draft EIS is available for review and comment.

Federal Agencies:

Bureau of Indian Affairs

Washington Office – Reston, Virginia

Uintah and Ouray Agency – Fort Duchesne, Utah

Bureau of Land Management

Washington Office – Washington, D.C.

Utah State Office – Salt Lake City, Utah

Colorado State Office – Denver, Colorado

Vernal Field Office – Vernal, Utah

Bureau of Reclamation

- Denver, Colorado
- Provo, Utah

Federal Depository Library System – Washington, D.C.

Federal Highway Administration – Salt Lake City, Utah

Minerals Management Service

- Herndon, Virginia
- Denver, Colorado

National Park Service

- Washington Office – Washington, D.C.
- Utah Office – Salt Lake City, Utah
- Dinosaur National Monument – Dinosaur, Colorado

Natural Resources Conservation Service – Provo, Utah

Office of Surface Mining – Washington, D.C.

U.S. Air Force – Washington, D.C.

U.S. Army Corps of Engineers, Sacramento District

- Sacramento, California
- Grand Junction, Colorado

U.S. Department of Energy, Office of Environmental Compliance

- Washington, D.C.
- Grand Junction, Colorado

U.S. Department of Interior

- Office of Environmental Policy and Compliance
  - Washington, D.C.
  - Denver, Colorado
- Natural Resources Library – Washington, D.C.

U.S. Environmental Protection Agency

- Office of Federal Activities – Washington, D.C.
- Region 8, NEPA Compliance Division – Denver, Colorado

U.S. Fish and Wildlife Service

- Division of Environmental Quality – Arlington, Virginia
- Colorado Field Office – Denver, Colorado
- Utah Field Office Ecological Services - West Valley City, Utah

U.S. Forest Service, Ashley National Forest – Vernal, Utah

U.S. Geological Survey

Environmental Affairs Program – Reston, Virginia

Region 8 – Denver, Colorado

State and Regional Agencies:

Public Land and Policy Coordination Office – Salt Lake City, Utah

Utah Department of Natural Resources, Division of Wildlife Resources – Vernal, Utah

Utah Division of State History – Salt Lake City, Utah

Antiquities Section

State Historic Preservation Office

Utah School and Institutional Trust Lands Administration – Salt Lake City, Utah

Counties:

Daggett County Commissioners – Manila, Utah

Duchesne County – Duchesne, Utah

Commissioners

Planning & Zoning

Uintah County – Vernal, Utah

Commissioners

Planning Office

Public Lands Committee

Municipalities:

Vernal Area Chamber of Commerce – Vernal, Utah

Media:

Deseret News – Salt Lake City, Utah

High Country News – Paonia, Colorado

KNEU Radio – Roosevelt, Utah

KVEL Radio – Vernal, Utah

The Salt Lake Tribune – Salt Lake City, Utah

Uintah Basin Standard – Roosevelt, Utah

Vernal Express – Vernal, Utah

Libraries:

Brigham Young University – Provo, Utah

Colorado State University Library – Fort Collins, Colorado

Harold B. Lee Library – Provo, Utah

J. Willard Marriott Library – Salt Lake City, Utah

Uintah County Library – Vernal, Utah

Utah State University Library – Logan, Utah

Elected Officials:

Senator Bob Bennett

Salt Lake City, Utah

Washington, D.C.

Senator Orrin Hatch

Salt Lake City, Utah

Washington, D.C.

Representative Jim Matheson

Salt Lake City, Utah

Washington, D.C.

Governor Gary Herbert – Salt Lake City, Utah

Utah State Senator Kevin Van Tassell – Vernal, Utah

State Representative John Mathis – Vernal, Utah

Mayor Gary Showalter – Vernal, Utah

Tribes:

Confederated Tribes of the Goshute Reservation – Ibapah, Utah

Eastern Shoshone Business Council – Fort Washakie, Wyoming

Hopi Tribal Council – Kykotsmovi, Arizona

Laguna Pueblo – Laguna, New Mexico

Navajo Nation – Window Rock, Arizona

Northwestern Band of Shoshone Nation – Brigham City, Utah

Santa Clara Pueblo – Espanola, New Mexico

Southern Ute Tribal Council – Ignacio, Colorado

Ute Indian Tribe – Fort Duchesne, Utah

Ute Mountain Ute – Towaoc, Colorado

White Mesa Ute Council – White Mesa, Utah

Zia Pueblo – Zia Pueblo, New Mexico

Organizations:

Center for Native Ecosystems – Denver, Colorado

Colorado Plateau Archaeological Alliance – Ogden, Utah

Earth Justice – Denver, Colorado

Oil & Gas Accountability Project – Durango, Colorado

Western Land Exchange Project – Seattle, Washington

Environmental Preservation Fund – Salt Lake City, Utah

Forest Guardians – Santa Fe, New Mexico

National Trust for Historic Preservation – Washington, D.C.

Natural Resource Defense Council – Washington, D.C.

Nine Mile Canyon Coalition – Price, Utah

Sierra Club – Salt Lake City, Utah

Southern Utah Wilderness Alliance – Salt Lake City, Utah

The Nature Conservancy – Salt Lake City, Utah

The Wilderness Society – Denver, Colorado

Theodore Roosevelt Conservation Partnership

Boulder, Colorado

Jackson, Wyoming

Uintah Mountain Club – Vernal, Utah

Utah Cattlemen's Association – Salt Lake City, Utah

Utah Environmental Congress – Salt Lake City, Utah

Utah Heritage Foundation – Salt Lake City, Utah

Utah Historic Trails Consortium – Taylorsville, Utah

Utah Professional Archaeological Council – Salt Lake City, Utah

Utah Rivers Council – Salt Lake City, Utah

Utah Rock Art Research Association – Salt Lake City, Utah

Businesses:

AECOM Environment

Golden, Colorado

Fort Collins, Colorado

Alameda Corp. – Book Cliffs Ranch – Roosevelt, Utah

American Gilsonite Company – Bonanza, Utah

Bjork, Lindley, & Little – Denver, Colorado

Budd-Falen Law Offices, LLC – Cheyenne, Wyoming

Buys & Associates – Littleton, Colorado

Elcan and Associates, Inc. – Mobile, Alabama

EOG Resources, Inc. – Denver, Colorado

Hiko Bell Mining & Oil Company – Vernal, Utah

LEXCO, Inc. – Vernal, Utah

OSO Energy Resources Corporation – Durango, Colorado

Petros Environmental Group, Inc. – Littleton, Colorado

Piney Valley Ranches Trust – Craig, Colorado

QEP Uinta Basin, Inc. – Vernal, Utah

R.W. McKamy – Billings, Montana

Smiling Lake Consulting – Evergreen, Colorado

TRC Mariah Association, Inc. – Laramie, Wyoming

Ziegler Chemical & Mineral Corp.

Bonanza, Utah

Jericho, New York

Individuals:

Cindy MacDonald – North Las Vegas, Nevada

Donald L. Morgan – Palo Alto, California

John Hunting – Vernal, Utah

Lane Lasrich – Sandy, Utah

Larry H. and Susan K. Robinson – Rifle, Colorado

Larry Q. Hutchins – Knoxville, Pennsylvania

Lenora & Clifford Smith – Maybelle, Colorado

Mike Kouris – Kinnear, Wyoming

Pablo Geronimo – Vernal, Utah

Wm. R. Robinson – Vernal, Utah

William R. Robinson – Jensen, Utah

6.2 Public Involvement

NEPA requires full disclosure and open public participation in the federal decision making process, including those projects proposed by non-federal proponents that require federal approval. There are two key points during the development of an EIS that the general public is invited to participate in the process: 1) during the scoping period, and 2) during the 30-day review period of the Draft EIS.

The NOI for the Greater Natural Buttes Project EIS was published in the *Federal Register* on October 5, 2007. This NOI included a project description and BLM contact information. On this same date, the BLM issued a press release containing a description of the proposed project; information about the public scoping meeting date, time, and location; and BLM contact information. Additionally, a card providing notice of the 30-day public scoping period was mailed to the interested parties on the BLM Vernal Field Office's NEPA mailing list. This

mailing list included a total of 93 individuals representing federal agencies, state agencies, local agencies, elected officials, tribes, the media and libraries in the vicinity, as well as other interested stakeholders.

The public scoping meeting held in Vernal, Utah on October 24, 2007, was attended by 7 individuals not affiliated with the BLM, KMG, or the third party NEPA contractor (AECOM). The official scoping period ended November 5, 2007. Nine written responses were received during the scoping period in response to this project. These include responses from:

- Bjork, Lindley, and Little Lawyers, PC on behalf of a number of oil and gas producers that explore and operate on public lands in Utah;
- Budd-Falen Law Offices, L.L.C. on behalf of William Robinson;
- EOG Resources, Inc.;
- State of Utah, Office of the Governor;
- Theodore Roosevelt Conservation Partnership;
- Uintah County Commission;
- USEPA, Region VIII;
- BIA, Western Region; and
- Mr. Larry Hutchins.

The issues and concerns identified by the public during the scoping period are summarized in Section 1.6.

The release of this Draft EIS will be followed by a 45-day comment period. Comments received will be reviewed and substantive comments will receive a response. Substantive comments and corresponding responses will be provided as an appendix to the Final EIS. Comments will be used to modify, clarify, and/or correct the Final EIS as appropriate.

6.3 List of Preparers and Reviewers

Table 6.3-1 identifies the BLM staff members on the EIS interdisciplinary team for the Project.

Table 6.3-1 BLM Interdisciplinary Team

Resource	Name
NEPA Coordinator	Stephanie Howard
Geology and Minerals	Jerry Kenczka
Paleontology	Blaine Phillips
Water Resources/Flood Plains	Stephanie Howard
Air Quality	Craig Nicholls, Leonard Herr, Bill Stringer
Soils	Steve Strong
Vegetation	Clayton Newberry
Wetlands/Riparian Areas	Stephanie Howard
Areas of Special Designation (ACECs, Natural Areas, etc.)	Jason West
Invasive and Non-native Species	Jessie Salix
Special Status Plants	Jessie Salix
Wildlife and Fisheries	Scott Ackerman
Special Status Animals	Scott Ackerman

Table 6.3-1 BLM Interdisciplinary Team

Resource	Name
Land Use and Access	Paul Rodriquez
Livestock Management and Grazing/Rangeland Health	Mark Wimmer, Michael Cutler
Recreation and BLM Natural Areas	Jason West
Wilderness Characteristics	Jason West
Visual Resources	Chuck Patterson
Socioeconomics	Stephanie Howard, Bill Stevens
Transportation	Paul Rodriquez
Cultural Resources	Blaine Phillips
Native American Concerns	Blaine Phillips
Environmental Justice	Stephanie Howard
Hazardous Materials and Solid Waste	Stephanie Howard
Fuels and Fire Management	Steven Strong

AECOM is the third-party environmental contractor responsible for preparing the EIS under the direction of the BLM. The responsibilities and experience of the individual team members are summarized in **Table 6.3-2.**

Table 6.3-2 Preparers/Reviewers for AECOM and Subcontractors

Name / Affiliation	Education	Responsibility
Mark Degner AECOM	B.S. Geology, 1982, University of Kansas	Senior Project Advisor, Project Description, Alternatives, Review
Dan Gregory AECOM	M.S. Geology, 1982, Colorado State University B.S. Geology, 1974, Colorado College	Project Manager, Project Description, Alternatives, Cumulative, Review
Molly Giere AECOM	M.B.A. Business Administration, 2002, University of Dayton B.S. Biology, 1988, The Ohio State University	Project Coordinator, Project Description, Alternatives, Public Participation
Richard Bell PetrosEnvironmental	Masters studies – Agronomy/Soil Science, Colorado State University B.A. Distributive Major: Biology, Geology, Chemistry; 1974, University of Colorado	NEPA Process Advisor, Project Description, Alternatives, Soils
Joe Fetzer PetrosEnvironmental	M.S. Geology, 1973, The Ohio State University B.S. Geology, 1970, The Ohio State University	Oil and Gas Technical Advisor, Project Description, Alternatives, Geology, Paleontology, Hazardous Materials and Solid Waste
Vince Scheetz AECOM	M.S. Systems Management, 1970, University of Southern California B.S. Mathematics / Meteorology, 1964, Regis University, Denver	Air Quality
Bruce MacDonald AECOM	Ph.D. Atmospheric Science, 1988, Colorado State University M.S. Atmospheric Science, 1974, Colorado State University B.A. Mathematics, 1967, North Dakota State University	Air Quality Technical Support Document

Table 6.3-2 Preparers/Reviewers for AECOM and Subcontractors

Name / Affiliation	Education	Responsibility
Eric Hodek AECOM	M.B.A. Business Administration, 2008, University of Colorado B.S. Environmental Sciences,1997, University of Oklahoma	Air Quality Technical Support Document
Kim Munson AECOM	M.A. Anthropology, 1997, Colorado State University B.A. Anthropology, 1994, Colorado	Cultural Resources and Native American Concerns
Steven Graber AECOM	B.S. Natural Resources Management, 2002, Colorado State University B.A. Economics, 2002, Colorado State University	Land Use, Recreation, Transportation
Erin Bergquist AECOM	M.S. Ecology, 2005, Colorado State University B.S. Environmental Studies and Economics, 1998, University of Colorado	Range Resources, Vegetation, Special Status Plants, Wetlands
Ron Dutton Sammons/Dutton, LLC	M.S. Economics, 1976, University of Wyoming B.S. Economics, 1974, University of Wyoming	Socioeconomics
Merlyn Paulson AECOM	MLA II Landscape Architecture and Geographic Information Systems, 1975, Harvard University BLA Landscape Architecture and Environmental Planning, 1972, Utah State University	Visual Resources, GIS
Jim Burrell AECOM	M.S. Civil Engineering, 1989, Colorado State University B.S. Forest Management, 1974, Colorado State University	Water Resources
Jen Ashlin AECOM	B.S. Geology and Environmental Science, 1999, University of California	Groundwater
Matt Brekke AECOM	B.S. Wildlife Biology, 2006,Colorado State University	Wildlife, Fisheries, Special Status Animals
Chris Gayer Grasslands Consulting	B.S. Biology, 2001, Metropolitan State College	Fisheries, Special Status Species (Plants and Animals)
Todd White AECOM	MDP Masters in Community Planning, 1999, University of Cincinnati MEn Masters in Environmental Science, 1992, Miami University M.A. Anthropology, 1989, University of Colorado B.A. Geology, 1989, Miami University	GIS, Qualitative Analysis
Peggy Roberts AECOM	M.S. Technical Communications (in progress), Colorado State University B.J. Journalism/Public Relation, 1997, The University of Texas at Austin	Public Outreach
Debbie Thompson AECOM	Colorado State University, coursework A.A.S. Business Secretary, 1985, Aims Community College	Document Production

7.0 Glossary

Acre-foot	Volume of water required to cover 1 acre to a depth of 1 foot; equivalent to a volume of 43,560 cubic feet, approximately 325,829 gallons, or approximately 7,758 barrels of water.
Alluvial	Pertaining to material or processes associated with transportation or deposition of soil and rock by flowing water (e.g., streams and rivers).
Alluvium	Unconsolidated or poorly consolidated gravel, sands, and clays deposited by streams
Ambient noise	Total, all-encompassing noise associated with a given environment and time.
Aquifer	A body of rock that is sufficiently permeable to conduct groundwater and to yield economically significant quantities of water to wells and springs.
Archaeology	The scientific study of material remains (as fossil relics, artifacts, and monuments) of past human life and activities.
Barrel	Volume of water equivalent to 42 gallons of water; approximately 7,758 barrels are equivalent to 1 acre-foot of water.
Biological soil crusts	The community of organisms living at the surface of desert soils. Major components are cyanobacteria, green algae, microfungi, mosses, liverworts, and lichens.
Blowout preventer	A large valve at the top of a well that may be closed if the drilling crew loses control of formation fluids.
Borehole	The wellbore itself, including the openhole or uncased portion of the well. Borehole may refer to the inside diameter of the wellbore wall, the rock face that bounds the drilled hole.
Botany	A branch of biology dealing with plant life.
Casing annulus	The space between the wellbore and casing where fluid can flow.
Completion	A generic term used to describe the assembly of downhole tubulars and equipment required to enable safe and efficient production from an oil or gas well.
Condensate	A low-density, high-API gravity liquid hydrocarbon phase that generally occurs in association with natural gas. Its presence as a liquid phase depends on temperature and pressure conditions in the reservoir allowing condensation of liquid from vapor.
Critical habitat	Habitat that is present in minimum amounts and is the determining factor in the potential for population maintenance and growth.

Crude oil	A general term for unrefined petroleum or liquid petroleum.
Cumulative effects	The combined environmental impacts that accrue over time and space from a series of similar or related individual actions, contaminants, or projects. Although each action may seem to have a negligible impact, the combined effect can be significant. Included are activities of the past, present, and reasonably foreseeable future; synonymous with cumulative impacts.
dBA	A-weighting. The most commonly used frequency weighting measure; simulates human sound perception and correlates well with human perception of the annoying aspects of noise.
Depletion	The drop in reservoir pressure or hydrocarbon reserves resulting from production of reservoir fluids.
Derrick	The structure used to support the crown blocks and the drillstring of a drilling rig. Derricks are usually pyramidal in shape, and offer a good strength-to-weight ratio.
Direct impacts	Impacts that are caused by the action and occur at the same time and place (40 Code of Federal Regulations 1508.7); synonymous with direct effects.
Directional drill	A means of subterranean drilling that can be carried out and controlled in terms of depth and direction.
Disturbed area	An area where natural vegetation and soils have been removed.
Drill cuttings	Small pieces of rock that break away due to the action of the bit teeth.
Dry hole	A wellbore that has not encountered hydrocarbons in economically producible quantities.
Endangered species	Any species in danger of extinction throughout all or a significant portion of its range. Plant or animal species identified by the Secretary of the Interior as endangered in accordance with the 1973 Endangered Species Act.
Evapotranspiration	The portion of precipitation returned to the air through evaporation and plant transpiration.
Fauna	Animal life.
Floodplain	That portion of a river valley, adjacent to the channel, that is built of sediments deposited during the present regimen of the stream and that is covered with water when the river overflows its banks at flood stages. The 100-year floodplain is that portion of the river valley adjacent to the channel, which has a 1 in 100 chance of being inundated in a given year.
Flora	Plant life.

Formation	A body of rock that is sufficiently distinctive and continuous that it can be mapped. In stratigraphy, a formation is a body of strata of predominantly one type or combination of types; multiple formations form groups, and subdivisions of formations are members.
Fugitive dust	Dust particles suspended randomly in the air from road travel, excavation, and rock loading operations.
Gathering pipeline	Typically smaller diameter pipelines connecting production wells to central gathering locations, such as tank batteries for hydrocarbon liquids or compressor stations for natural gas. For natural gas, gathering pipelines are upstream of transmission pipelines, which are upstream of distribution pipelines.
Hydrocarbon resources	Naturally occurring organic compounds comprising hydrogen and carbon. The most common hydrocarbons are natural gas, oil, and coal.
Impact	A modification in the status of the environment brought about by the Proposed Action or an alternative.
Indirect impacts	Impacts that are caused by the action and are later in time or farther removed in distance but are still reasonably foreseeable (40 Code of Federal Regulations 1508.8); synonymous with indirect effects.
Injection well	A well in which fluids are injected rather than produced, the primary objective typically being to maintain reservoir pressure. Two main types of injection are gas and water.
Intermittent stream	A stream that flows only part of the time or during part of the year.
Irretrievable	Applies primarily to the lost production of renewable natural resources during the life of the project.
Irreversible	Applies primarily to the use of nonrenewable resources, such as minerals, cultural resources, wetlands, or to those factors that are renewable only over long time spans, such as soil productivity. Irreversible also includes loss of future options.
Lek	An assembly area where grouse conduct display and courtship behavior.
Migration	The long-distance movement of wildlife, usually between breeding and non-breeding areas.
Mitigate, Mitigation	To cause to become less severe or harmful; actions to avoid, minimize, rectify, reduce or eliminate, and compensate for impacts to environmental resources.

Mud	A term that is generally synonymous with drilling fluid and that encompasses most fluids used in hydrocarbon drilling operations, especially fluids that contain significant amounts of suspended solids, emulsified water, or oil.
National Environmental Policy Act	The National Environmental Policy Act (NEPA) of 1969; the national charter for protecting the environment. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Regulations from 40 Code of Federal Regulations 1500-1508 implement the act.
National Pollutant Discharge Elimination System (NPDES)	A part of the Clean Water Act that requires point source dischargers to obtain Elimination System permits. These permits are referred to as NPDES permits and are administered by the U.S. Environmental Protection Agency.
National Register of Historic Places (NRHP)	A list, maintained by the National Park Service, of areas that have been designated as being of historical significance.
Native species	Plants that originated in the area in which they are found (i.e., they naturally occur in that area).
Noise	Unwanted sound; one that interferes with one's hearing of something; a sound that lacks agreeable musical quality or is noticeably unpleasant.
Paleontology	A science dealing with the life of past geological periods as known from fossil remains.
Perforation	The communication tunnel created from the casing or liner into the reservoir formation, through which oil or gas is produced.
Perennial stream	A stream or reach of a stream that flows throughout the year.
Plug and abandon	To prepare a well to be closed permanently, usually after either logs determine there is insufficient hydrocarbon potential to complete the well, or after production operations have drained the reservoir.
Primary production or recovery	The means by which the initial reservoir production is achieved, such as natural production from a gas-drive reservoir. In many cases, a secondary recovery method, such as waterflood, is required to maintain a viable reservoir production rate.
Produced water	Groundwater pumped to the surface during reservoir production.
Production tubing	A wellbore tubular used to produce reservoir fluids. Production tubing is assembled with other completion components to make up the production string.
Raptor	Birds of prey, such as hawks, eagles, and owls.

Reclamation	Rehabilitation of a disturbed area to make it acceptable for designated uses. This process consists of two stages, interim and final: *Interim Reclamation* – Involves shaping, stabilizing, re-vegetating, or otherwise treating disturbed areas in order to provide a self-sustaining and productive use of the land during production operations. *Final Reclamation* – Involves returning the land to a condition after production and operations cease that approximates the condition prior to disturbance and maintains a stable and productive condition compatible with the land use.
Reserve pit	An earthen-bermed storage area for discarded drilling mud.
Reservoir	A subsurface body of rock having sufficient porosity and permeability to store and transmit fluids.
Rig	The machine used to drill a wellbore. The rig includes virtually everything except living quarters. Major components of the rig include the mud tanks, the mud pumps, the derrick or mast, the drawworks, the rotary table or topdrive, the drillstring, the power generation equipment and auxiliary equipment.
Right-of-Way (ROW)	Strip of land or corridor designated via an administrative grant through which a pipeline, power line, access road, or maintenance road would pass.
Riparian	Situated on or pertaining to the bank of a river, stream, or other body of water. Riparian is normally used to refer to plants of all types that grow along streams, rivers, or at spring and seep sites.
Roost	A place where birds customarily rest.
Runoff	That part of precipitation that appears in surface streams; precipitation that is not retained on the site where it falls and is not absorbed by the soil.
Scoping	Discussion with and disclosure to agencies and the public with regard to a project or undertaking wherein areas of concern or issues to be addressed in a NEPA document are determined.
Sediment	Material suspended in or settling to the bottom of a liquid. Sediment input comes from natural sources, such as soil erosion and rock weathering, as well as construction activities or anthropogenic sources, such as forest or agricultural practices.
Sediment yield	Quantification of the amount of sediment transported.

Seismic	Pertaining to waves of elastic energy, such as that transmitted by P-waves and S-waves, in the frequency range of approximately 1 to 100 Hz. Seismic energy is studied by scientists to interpret the composition, fluid content, extent and geometry of rocks in the subsurface. Also – of, subject to, or caused by an earthquake; of or relating to an earth vibration caused by something else.
Seismicity	Relative degree to which an area is subject to earth movement caused by earthquakes or other seismic activity.
Shale	A fine-grained, fissile, detrital sedimentary rock formed by consolidation of clay- and silt-sized particles into thin, relatively impermeable layers. It is the most abundant sedimentary rock.
Stratigraphy	Form, arrangement, geographic distribution, chronological succession, classification, and relationships of rock strata.
Tertiary	The geologic span of time between 65 and 3 to 2 million years ago.
Threatened species	Any species of plant or animal that is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.
Visual resource	The composite of basic terrain, geologic features, water features, vegetation patterns, and land use effects that typify a land unit and influence the visual appeal the unit may have for viewers.
Water disposal well	A well used for disposal or injection of produced water or other fluids.
Watershed	A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water.
Well casing	Large-diameter pipe lowered into an openhole and cemented in place. The well designer must design casing to withstand a variety of forces, such as collapse, burst, and tensile failure, as well as chemically aggressive brines. Casing is run to protect fresh-water formations, isolate a zone of lost returns or isolate formations with significantly different pressure gradients.
Well pad	A temporary drilling site, usually constructed of local materials such as gravel, shell or even wood. After the drilling operation is over, most of the pad is usually removed or contoured.
Wellbore	Synonym: borehole.
Wellhead	The surface termination of a wellbore that incorporates facilities for installing casing hangers during the well construction phase.

Wetlands	Areas that are inundated by surface or groundwater with a frequency sufficient to support (and under normal circumstances do or would support) a prevalence of vegetation or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction.
Workover	The process of performing major maintenance or remedial treatments on an oil or gas well. In many cases, workover implies the removal and replacement of the production tubing string after the well has been killed and a workover rig has been placed on location.
Zone	A slab of reservoir rock bounded above and below by impermeable rock.

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